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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES WORLDWIDE JANUARY 22 1990

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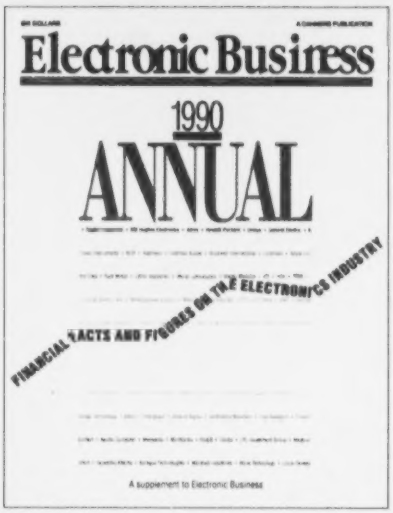
A supplement to Electronic Business



Program sellers call out at baseball games: "You can't tell the players without a scorecard." Packed with lifetime batting statistics, earned run averages and other data, the programs are indispensable to true aficionados of the game.

Followers of the electronics industry often feel the need for a program of their own. With that in mind, the editors of ELECTRONIC BUSINESS bring you this special annual supplement, a collection that should prove a useful reference tool even beyond 1990.

The supplement pools seven of the most informative rankings published in the 1989 issues of ELECTRONIC BUSINESS — from the widely quoted ELECTRONIC BUSINESS 200 to a roll call of the 100 electronics companies with the highest level of R&D spending. Each list, compiled from the most recent data available when first published, is the product of painstaking original research by our editors.

Leading off the supplement is the ELECTRONIC BUSINESS 200, a ranking by revenue of the top 200 publicly held U.S. electronics companies, which is as important to senior executives in the electronics industry as the *Fortune* 500 is to the general business world. The ELECTRONIC BUSINESS 200 also breaks down the rankings according to industry segments and lists the best and worst performers in such areas as return on equity, sales per employee and five-year revenue growth.

In the past year many electronics companies focused sharply on the changes expected to sweep across Europe in 1992 and on Japan's growing influence within the industry. In keeping with this growing concern, this special issue includes the ELECTRONIC BUSINESS listing of the top companies in Europe and Japan.

The supplement also includes ELECTRONIC BUSINESS' list of the industry's fastest growing companies, a list of the industry's most profitable companies and a tally of the top R&D spenders which will — we hope — provide inspiration for the rest of the industry. A list of the industry's top capital spenders rounds out the issue.

Of course, these rankings provide only a snapshot of the fast-moving electronics industry. Yesterday's king of the hill may be today's fallen star or acquisition target. One case in point is Sun Microsystems, which after being named the fastest growing company, suffered a $20 million loss in its fiscal 1989 fourth quarter because of rapidly escalating expenses and an overhaul of the company's management information system.

Or, consider the plights of Cullinet Software Inc. and Apollo Computer Inc., companies that will never again appear in ELECTRONIC BUSINESS' rankings as independent entities because they were acquired by larger companies. Prime Computer Inc. was the target of a leveraged buyout by the J.H. Whitney & Co. investment firm. And Mini-Scribe Corp., which placed 27th on the list of fastest growing companies, has since admitted that its financial statements for the past three years were falsified to inflate sales and income.

All of which proves that the old adage "nothing endures but change" is quite true in the electronics industry. Which makes our job a lot more interesting. And which makes regular supplements like this a lot more valuable.

RICK WHITING

TOP PERFORMERS IN ELECTRONICS, COMPUTERS AND SYSTEMS — WORLDWIDE

8 **ELECTRONIC BUSINESS 200**
Total sales grew 9.5% to $327 billion, but most of the growth was fueled by foreign sales, which rose 42.1%. U.S. sales were only up 2.4%, suggesting that the domestic market is slowing down.

44 **Top Japanese companies**
Japan's leading electronics companies have recovered from the effects of the high-valued yen. But increasing global competition means that the Japanese no longer have the edge they once did.

53 **Top companies in Europe**
With 1992 fast approaching, European electronics companies are busy merging in a scramble to build pan-European empires.

61 **Fastest growing companies**
For the second year in a row, Sun Microsystems leads the list of fastest growing electronics and computer companies with a five-year compounded annual growth rate of 161%.

81 **Most profitable companies**
The 100 most profitable U.S. electronics firms posted a 12% gain in after-tax profit in 1988. They net 64% more than U.S. industry overall.

90 **Top R&D spenders**
Led by software, capital equipment and semiconductor sectors, R&D spending by U.S. electronics and computer companies was up 15.7% in 1988.

105 **Top capital spenders**
Capital spending by the top U.S. electronics companies hit a four-year high in 1988, posting a healthy 28% growth over 1987. But last year's good performance is expected to be the peak of the cycle.

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2008

The top line rises 9.5%, but the bottom line falls 3.3%

The ELECTRONIC BUSINESS 200, compiled over several months by senior editor Linda Stallmann, is an exclusive report that analyzes the financial statements of the 200 largest, publicly held electronics, computer and systems manufacturers based in the United States. The intent of our research is to provide an accurate gauge of the current status—and future direction—of the industry. In capsule, 1988 was an upbeat year on the sales front for the U.S. electronics industry, but nonetheless a year rife with disturbing financial indicators.

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Software firms lead in productivity, followed closely by microcomputers

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Alphabetical index
An alphabetical listing of the 200 companies, including rank

Vibrant foreign sales can't mask discouraging indicators

While foreign sales for the 200 flourish, U.S. sales and total profits flounder. Two other key indicators — return on investment and return on equity — are both down

BY LINDA STALLMANN AND BRUCE C.P. RAYNER

The U.S. electronics industry isn't exactly sick. But according to the 1988 ELECTRONIC BUSINESS 200, an exclusive annual listing of the top 200 public electronics companies in the country, its vital signs indicate a financial weakness that foretells chronic problems.

The ELECTRONIC BUSINESS 200, gleaned from countless annual reports, 10-K filings, exclusive interviews and internal estimates, gives a glimpse into last year's performance by electronics companies at the top of the heap. It also provides insight into the direction of the U.S. electronics industry.

What the figures show is not encouraging.

Sure, total sales grew 9.5% to $327.7 billion in 1988, up from $299.2 billion in 1987. That rates as the best growth since the boom year of 1984, when annual growth measured a healthy 13.4%. But the improvement in sales is deceiving, since they come almost exclusively from foreign markets. In fact, foreign sales of the ELECTRONIC BUSINESS 200 rose 42.1%, while U.S. sales were up only 2.4% — suggesting that the domestic economy is slowing down for these companies.

The reason? A maturing U.S. market and stiff foreign competition from Japan and Europe. The top U.S. electronics companies, most of them transnationals, are focusing more and more on growing foreign markets across both the Pacific and Atlantic oceans. In particular, they are scrambling to get into Europe by the end of 1992, when intra-European trade barriers will come down.

IBM: 4.4% profits increase

Indicative of this trend is IBM, the top performer on the ELECTRONIC BUSINESS 200 since it was first published in 1978. In 1988, IBM posted total sales growth of 8%, with overseas sales of $34.4 billion and growing at a rate of 15.5%. Big Blue's U.S. sales, however, slipped marginally to $25.3 billion from $25.5 billion in 1987. IBM's 1988 profits accentuate the trend set by sales: up by 22.3% in foreign markets, down by 27.3% in the United States, for a total net profit increase of 4.4% (before the effect of an accounting change).

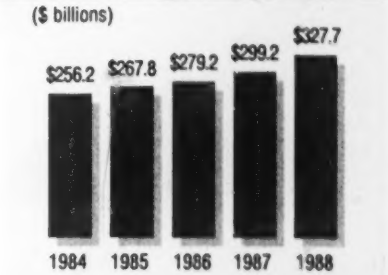
IBM's overall profit growth is an exception to the rule. Net income for the top 200 U.S. electronics companies fell by 3.3%, after logging a stellar 53.7% growth in 1987. This year's poor performance makes it three out of the last five years that the ELECTRONIC BUSINESS 200 listing has posted negative profit growth. True, it is hard to follow up a year like 1987, but the wild swings since 1984

Composite performance of the ELECTRONIC BUSINESS 200

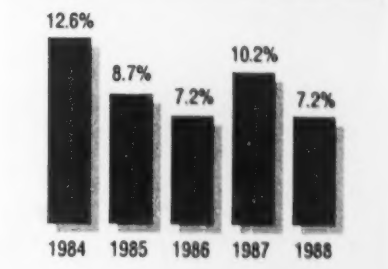
	1984	1985	1986	1987	1988
Electronics sales ($ billions)	$256.2	$267.8	$279.2	$299.2	$327.7
Total sales ($ billions)	$776.5	$797.8	$641.7	$689.7	$774.5
Total net income ($ billions)	$46.4	$35.4	$26.7	$41.0	$39.7

WEIGHTED AVERAGES	1984	1985	1986	1987	1988
Return on equity	16.5%	11.8%	10.2%	14.1%	13.1%
Return on investment	12.6%	8.7%	7.2%	10.2%	7.2%
Cost of goods sold/sales	69.4%	70.3%	63.7%	61.5%	58.6%
R&D/sales	4.2%	4.2%	5.0%	5.2%	5.1%
Sales per employee	$103,200	$110,800	$102,348	$113,533	$128,756
Net income per employee	$6,300	$5,000	$4,266	$6,662	$6,646
5-year compound annual growth					
Sales	+8.5%	+5.0%	+8.2%	+10.7%	+11.5%
Net income	+11.6%	+1.4%	+4.0%	+13.9%	+8.3%
Capital outlay to net cash flow after dividends	96.0%	118.3%	97.9%	73.9%	83.8%
Debt/total capital	23.5%	26.7%	29.9%	28.2%	45.3%
Foreign sales/total sales	—	14.0%	25.4%	24.9%	31.5%

Electronics sales



Return on investment



have serious implications for the industry's long-term health.

In total, 28 of the ELECTRONIC BUSINESS 200 are red-ink companies in 1988, up from 23 in 1987. No. 2 AT&T stands out from the pack with a net loss last year of $1.67 billion, a result of a $6.7 billion equipment write-off. Similarly, Honeywell Inc., ranked 10th, posted a net loss of $434.9 million due to military-contract losses and restructuring. Other heavy losers include Combustion Engineering Inc., Cullinet Software Inc. (which competitor Computer Associates Inc. recently agreed to buy), LTV Corp. and Sundstrand Corp.

Lower profits mean fewer investments from retained earnings in the future. A sign of this is the five-year figures for capital outlays made from net-cash flow — a gauge of capital investment and an indicator of competitiveness. When profits go up, capital outlays go up, usually with a lag of one year. Last year was no exception. As a result of '87 profits, '88 capital outlays rose to 83.8% of net-cash flow, up from 73.9% in 1987.

That's usually a good sign. But for three years in a row, this figure has been less than 100%. As a rule of thumb, anything less than 100% implies a capital base being compromised for short-term profit. In the capital-intensive, cutthroat electronics industry, this is indeed cause for concern. And with falling profits this year, the industry can look for even smaller percentages next year.

ROI, ROE both drop

Other financial indicators give rise to concern, too. Both return on investment and return on equity declined last year. ROI at 7.2% was down from 10.2% in 1987. Similarly, ROE dropped from 14.1% in 1987 to 13.1% in 1988. Both of these figures give credence to Wall Street's opinion that electronics — especially the semiconductor field — is losing its investment appeal.

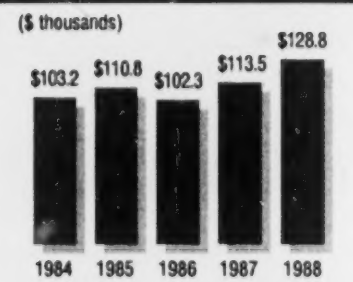
Foreign sales of the ELECTRONIC BUSINESS 200 rose 42.1%, while U.S. sales were up only 2.4%

But, of course, aggregation masks individual performance. This year's list had its share of successes. Micron Technology Inc., for example, the Idaho-based DRAM maker, came from nowhere to nab the 107th position in 1988. The company rode the DRAM shortage to capture sales of $368 million for calendar year 1988, up from $116 million in 1987.

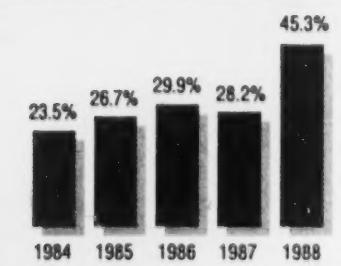
In all, this year's list has 22 new entrants. Most of these additions replaced companies that went private or were acquired. In fact, only seven of the 22 that fell off the list did so because of inadequate sales growth. Notable departures include Computervision Corp., acquired by Prime Computer Inc., itself a target of a hostile takeover bid; Convergent Inc., bought by Unisys Corp.; Gould Inc., sold to Nippon Mining Co. Ltd.; and The Singer Co., bought by corporate raider Paul Bilzerian.

Restructuring has its upside and its downside. It has meant a more productive industry, with sales per employee coming in at a strong 13.4% growth rate in 1988, up from 10.9% in 1987. But it has also meant a growing debt burden. For the ELECTRONIC BUSINESS 200, debt as a percentage of total capital shot up by 60.6% last year and is now up to a dangerous and unprecedented 45.3%. The consequences could be severe if the economy heads south later this year, as many financial experts predict. □

Sales/employee



Debt/total capital



Notes to the ELECTRONIC BUSINESS 200

Revenue (sales)
Revenue includes sales of products, services and rentals, but excludes dividends, interest and other non-operating revenue.

Profit
Profits are shown after taxes from continuing operations and before extraordinary items.

Return on equity
ROE is profits as a percentage of shareholders' equity (preferred stock, capital stock, surplus and retained earnings at the company's year-end).

Return on investment
ROI is profits as a percentage of shareholders' equity plus short-term debt and long-term debt. Short-term debt includes the current portion of long-term debt, notes payable and other borrowings.

Cost of goods sold
This includes manufacturing costs of products, services and rentals sold, less depreciation as a percentage of revenue.

Research and development
R&D is company-sponsored research and development expenses as a percentage of revenue.

Employees
The number of employees is supplied by each company. In most cases this number represents year-end employment.

Capital expenditures to net cash flow
Capital expenditures are measured as a percentage of net profits from continuing operations plus depreciation, minus cash dividends paid.

Debt to total capital
This includes long-term debt plus short-term debt as a percentage of shareholders' equity and long- and short-term debt.

Foreign sales
These include sales of operations outside the United States to unaffiliated customers and U.S. operations' export sales.

THE ELECTRONIC BUSINESS 200

FINANCIAL TABLES: 1-50

Rank 1988	Rank 1987	Company	Calendar year 1988 Electronics revenue ($ millions)	Calendar year 1988 Total revenue ($ millions)	Calendar year 1988 Net income ($ millions)	Fiscal year 1988 Total revenue ($ millions)	Fiscal year 1988 Net income ($ millions)	Return on equity	Return on investment
1	1	IBM	$59,681	$59,681.0	$5,491.0	$59,681.0	$5,491.0	13.9%	10.4%
2	2	AT&T	14,377	35,210.0	-1,669.0	35,210.0	-1,669.0	-14.6%	-8.1%
3	4	Digital Equipment	12,285	12,284.7	1,209.2	11,475.5	1,305.6	17.4%	16.8%
4	3	GM Hughes Electronics	11,244	11,243.6	634.6	11,243.6	634.6	8.4%	7.4%
5	7	Xerox[1]	11,152	11,476.0	73.0	11,476.0	73.0	6.8%	2.9%
6	8	Hewlett-Packard	10,296	10,296.0	830.0	9,831.0	816.0	18.0%	16.0%
7	5	Unisys	9,902	9,902.0	680.6	9,902.0	680.6	13.7%	8.0%
8	6	General Electric	9,300	40,292.0	3,386.0	40,292.0	3,386.0	18.3%	12.8%
9	9	Motorola	8,250	8,250.0	445.0	8,250.0	445.0	13.2%	9.4%
10	10	Honeywell	7,148	7,148.3	-434.9	7,148.3	-434.9	-25.1%	-15.3%
11	12	Texas Instruments	6,295	6,295.0	336.0	6,294.8	366.3	16.3%	12.7%
12	11	NCR	5,990	5,989.9	439.3	5,989.9	439.3	19.6%	16.1%
13	14	Raytheon	4,994	8,192.1	489.6	8,192.1	489.6	23.1%	15.9%
14	15	Eastman Kodak	4,830	17,034.0	1,397.0	17,034.0	1,397.0	20.6%	8.4%
15	16	Rockwell International	4,593	12,133.8	779.0	11,946.3	811.9	22.0%	17.5%
16	13	Lockheed	4,554	10,590.0	442.0	10,590.0	442.0	17.9%	12.9%
17	22	Apple Computer	4,434	4,434.1	419.3	4,071.4	400.3	39.9%	35.4%
18	17	Tandy	3,992	3,992.3	321.3	3,793.8	316.4	19.7%	15.3%
19	26	Control Data	3,628	3,628.3	1.7	3,628.3	1.7	0.2%	0.1%
20	24	Ford Motor	3,350	92,445.6	5,300.2	92,445.6	5,300.2	24.6%	5.8%
21	20	Litton Industries	3,326	4,942.4	172.0	4,863.9	167.0	14.2%	6.1%
22	21	Wang Laboratories	3,075	3,074.5	50.3	3,068.4	92.7	5.8%	4.1%
23	23	Martin Marietta	3,058	5,727.5	319.8	5,727.5	319.8	26.6%	18.9%
24	25	3M	3,000	10,581.0	1,154.0	10,581.0	1,154.0	20.9%	18.4%
25	35	Intel	2,875	2,874.8	452.9	2,874.8	452.9	21.8%	16.3%
26	19	TRW	2,842	6,982.0	261.0	6,982.0	261.0	16.7%	10.2%
27	18	Allied-Signal	2,750	11,909.0	463.0	11,909.0	463.0	14.2%	8.3%
28	29	Zenith Electronics	2,686	2,685.7	5.3	2,685.7	5.3	1.1%	0.6%
29	28	Westinghouse Electric	2,672	12,499.5	822.8	12,449.5	822.8	21.7%	6.5%
30	36	National Semiconductor	2,667	2,666.8	-18.1	2,469.7	62.7	6.2%	5.9%
31	27	ITT	2,539	19,355.0	858.0	19,355.0	817.0	10.2%	5.4%
32	32	Du Pont	2,300	32,917.0	2,190.0	32,917.0	2,190.0	14.1%	10.5%
33	34	AMP	2,269	2,669.7	319.1	2,699.7	319.1	21.0%	18.3%
34	33	Boeing	2,231	16,962.0	614.0	16,962.0	614.0	11.4%	10.8%
35	39	Emerson Electric	2,200	6,793.1	540.7	6,651.5	528.8	18.8%	14.5%
36	30	Harris	2,105	2,104.8	69.6	2,099.3	65.4	6.7%	5.8%
37	47	Compaq Computer	2,066	2,065.6	255.2	2,065.6	255.2	31.3%	23.4%
38	31	Pitney Bowes	2,020	2,649.9	237.0	2,649.9	237.0	18.7%	6.5%
39	38	GTE	2,000	16,459.9	1,224.7	16,460.0	1,177.0	12.4%	5.6%
40	41	Amdahl	1,802	1,801.8	213.8	1,801.8	213.8	21.2%	18.5%
41	37	McDonnell Douglas	1,800	15,072.0	350.0	15,072.0	350.0	11.0%	5.1%
42	42	Avnet	1,718	1,938.3	50.6	1,829.3	52.2	7.5%	5.7%
43	58	Prime Computer	1,595	1,594.6	13.0	1,594.6	13.0	2.4%	1.8%
44	65	Sun Microsystems	1,462	1,461.6	89.6	1,051.6	66.4	18.0%	12.6%
45	44	Tektronix	1,431	1,431.0	-8.6	1,411.9	-16.7	-3.4%	-2.3%
46	52	Tandem Computers	1,425	1,424.7	102.1	1,314.7	94.5	11.0%	9.5%
47	53	Seagate Technology	1,351	1,351.0	-5.5	1,257.0	77.3	17.7%	10.4%
48	45	Data General	1,331	1,330.5	-48.8	1,364.7	-15.5	-2.5%	-2.2%
49	59	Chrysler	1,300	31,884.2	1,050.2	31,884.2	1,050.2	13.9%	3.0%
50	54	E-Systems	1,298	1,439.0	74.6	1,443.1	74.6	15.2%	12.5%

NA = not available
NM = not meaningful

[1] Xerox data is for business products and systems only, except for ROE, ROI, capital expenditures to net cash flow and debt to total capital

Cost of goods as a percentage of revenue	Fiscal year 1988 R&D as a percentage of revenue	Revenue per employee ($ thousands)	Net income per employee ($ thousands)	Five-year growth (Compounded average annual growth rate) Revenue	Net income	Capital outlays to net cash flow after dividends	Debt as a percentage of total capital	Foreign revenue as a percentage of total revenue	Fiscal year ended
35.0%	9.9%	$154.2	$14.2	5.4%	0.0%	70.5%	25.3%	57.6%	12/88
56.5%	7.3%	115.7	-5.5	NA	NA	539.3%	44.7%	0.0%	12/88
43.1%	11.4%	91.4	10.4	21.9%	35.7%	82.8%	3.6%	49.9%	6/88
70.7%	4.9%	115.9	6.5	NA	NA	55.7%	11.9%	12.3%	12/88
43.5%	6.9%	114.6	0.7	7.5%	NA	167.7%	58.1%	49.5%	12/88
44.3%	10.4%	113.0	9.4	15.9%	13.6%	57.9%	11.1%	51.6%	10/88
49.4%	7.2%	106.5	7.3	18.2%	28.2%	60.0%	41.7%	45.8%	12/88
67.9%	3.0%	134.3	11.3	7.8%	11.1%	51.7%	30.4%	39.0%	12/88
54.5%	8.1%	80.9	4.4	13.8%	12.8%	96.5%	29.0%	48.1%	12/88
71.9%	4.5%	91.2	-5.5	11.0%	NM	-136.0%	39.2%	22.9%	12/88
70.3%	7.8%	83.2	4.8	6.6%	NM	93.9%	22.4%	32.3%	12/88
48.5%	7.0%	99.8	7.3	9.9%	8.8%	66.1%	17.9%	58.3%	12/88
76.6%	3.3%	107.5	6.4	7.8%	9.7%	68.4%	31.0%	19.0%	12/88
49.4%	6.7%	117.2	9.6	10.9%	19.8%	96.7%	59.2%	43.9%	12/88
75.5%	3.6%	106.5	7.2	8.1%	15.8%	49.7%	20.4%	21.6%	9/88
NA	5.1%	122.0	5.1	11.5%	10.9%	52.5%	27.8%	11.1%	12/88
47.0%	6.7%	377.0	37.1	32.9%	44.2%	32.9%	11.3%	32.1%	9/88
47.5%	0.0%	102.5	8.6	11.1%	3.3%	28.1%	22.3%	1.8%	6/88
64.2%	9.3%	108.3	0.1	1.3%	-58.1%	86.6%	28.5%	29.8%	12/88
63.3%	3.2%	257.6	14.8	15.8%	23.2%	59.9%	76.5%	32.7%	12/88
74.2%	4.7%	88.4	3.0	4.2%	-7.8%	64.6%	57.0%	26.9%	7/88
40.3%	8.0%	99.3	3.0	14.8%	-9.4%	79.8%	29.4%	46.2%	6/88
78.8%	3.4%	86.8	4.8	12.2%	14.6%	73.7%	28.9%	0.0%	12/88
51.7%	6.5%	127.5	13.9	8.5%	11.6%	64.4%	12.0%	40.0%	12/88
45.0%	11.1%	138.2	21.8	20.7%	31.3%	71.9%	25.1%	42.9%	12/88
74.7%	5.1%	89.6	3.3	7.6%	7.5%	81.6%	38.6%	28.6%	12/88
77.2%	5.4%	108.7	4.2	6.5%	0.7%	98.7%	41.3%	35.3%	12/88
82.3%	3.7%	74.6	0.1	14.6%	-35.2%	68.0%	45.2%	17.9%	12/88
70.3%	5.7%	104.1	6.9	5.5%	12.9%	47.3%	69.8%	19.6%	12/88
63.3%	11.3%	65.5	1.7	15.3%	NM	85.5%	3.8%	45.2%	5/88
36.8%	2.7%	165.4	7.0	-0.9%	3.9%	46.6%	46.5%	28.6%	12/88
49.3%	4.0%	233.5	15.5	2.7%	14.2%	114.0%	25.4%	51.9%	12/88
56.1%	8.8%	112.0	13.2	12.2%	14.4%	59.6%	12.9%	53.6%	12/88
84.4%	4.4%	115.2	4.2	8.8%	11.6%	73.1%	4.6%	46.3%	12/88
63.2%	3.1%	93.9	7.5	11.8%	9.9%	44.7%	22.5%	28.1%	9/88
60.5%	5.6%	92.9	2.9	3.0%	0.5%	47.9%	13.2%	15.0%	6/88
57.3%	3.6%	299.4	37.0	79.4%	150.3%	89.9%	25.2%	38.6%	12/88
27.3%	3.0%	90.4	8.1	10.8%	15.8%	93.5%	65.2%	21.0%	12/88
61.3%	1.8%	103.5	7.4	6.1%	4.4%	109.0%	54.7%	14.7%	12/88
47.5%	12.3%	217.1	25.8	18.3%	37.7%	88.4%	12.5%	43.2%	12/88
77.6%	4.0%	124.1	2.9	8.9%	1.5%	98.9%	53.2%	21.8%	12/88
73.8%	0.0%	182.9	5.2	9.4%	0.7%	38.9%	24.6%	0.0%	6/88
40.7%	10.9%	128.7	1.0	25.3%	-16.8%	80.6%	25.3%	56.6%	12/88
47.5%	13.3%	148.3	9.4	161.2%	152.0%	100.0%	29.6%	38.4%	6/88
42.8%	15.3%	87.8	-1.0	3.5%	NM	164.9%	31.9%	44.4%	5/88
30.6%	12.9%	152.4	11.0	25.7%	25.1%	102.6%	14.0%	51.0%	9/88
78.0%	4.0%	41.9	2.6	62.7%	43.9%	221.7%	41.2%	40.5%	6/88
43.1%	12.1%	88.5	-1.0	10.5%	NM	116.6%	14.1%	46.0%	9/88
78.4%	2.8%	244.8	8.1	19.2%	28.3%	82.3%	78.2%	12.9%	12/88
63.1%	NA	86.3	4.5	13.2%	6.9%	57.6%	17.8%	10.4%	12/88

(Continued)

THE ELECTRONIC BUSINESS 200

FINANCIAL TABLES: 51-100

Rank 1988	Rank 1987	Company	Calendar year 1988 Electronics revenue ($ millions)	Calendar year 1988 Total revenue ($ millions)	Calendar year 1988 Net income ($ millions)	Fiscal year 1988 Total revenue ($ millions)	Fiscal year 1988 Net income ($ millions)	Return on equity	Return on investment
51	50	General Instrument	$1,268	$1,268.3	$84.3	$1,155.5	$66.2	12.0%	9.1%
52	56	Varian Associates	1,193	1,193.0	54.7	1,170.6	27.8	6.2%	5.5%
53	55	General Dynamics	1,180	9,551.0	379.0	9,551.0	379.0	19.7%	12.5%
54	57	Advanced Micro Devices	1,126	1,125.9	19.3	1,125.9	19.3	3.8%	2.7%
55	61	Loral	1,105	1,493.4	85.2	1,440.8	74.3	17.0%	7.3%
56	49	Northrop	1,087	5,797.1	-30.9	5,797.1	-30.9	-3.1%	-1.5%
57	46	Perkin-Elmer	1,078	1,200.7	63.7	1,165.5	60.0	8.3%	6.3%
58	43	United Technologies	1,050	18,000.1	659.1	18,000.1	659.1	13.7%	11.4%
59	77	Arrow Electronics	1,006	1,006.4	9.7	1,006.4	9.7	6.6%	3.4%
60	48	Teledyne	989	3,532.6	391.8	3,534.6	391.8	18.3%	14.5%
61	51	Grumman	985	3,648.9	86.5	3,648.9	86.5	10.5%	5.0%
62	76	Western Digital	973	972.9	48.3	768.3	43.0	16.9%	11.4%
63	74	Computer Associates	925	925.3	142.4	709.1	101.8	20.4%	16.4%
64	73	SCI Systems	900	900.1	20.3	777.7	19.0	12.5%	5.2%
65	62	Johnson Controls	881	3,227.2	104.6	3,099.6	103.5	12.1%	7.9%
66	66	Storage Technology	874	874.0	44.2	874.0	44.2	15.6%	7.4%
67	64	Eaton	860	3,468.5	227.7	3,468.5	227.7	19.7%	12.2%
68	71	Intergraph	800	800.2	88.0	800.2	88.0	13.2%	13.1%
69	70	General Signal	800	1,760.2	25.2	1,760.2	25.2	5.5%	2.6%
70	67	SmithKline Beckman	770	4,749.0	229.2	4,749.0	229.2	14.8%	7.8%
71	68	Cray Research	756	756.3	156.6	756.3	156.6	23.1%	19.7%
72	63	Emerson Radio	722	721.7	5.3	728.8	-12.0	-15.3%	-5.1%
73	86	Microsoft	719	718.6	151.4	590.8	123.9	33.0%	31.3%
74	96	Emhart	700	2,762.5	126.6	2,762.5	126.6	13.0%	7.3%
75	78	Apollo Computer	654	653.5	0.2	653.5	0.2	0.1%	0.1%
76	72	Monsanto	647	8,293.0	591.0	8,293.0	591.0	15.6%	10.3%
77	101	MiniScribe	603	603.3	25.9	603.3	25.9	NA	NA
78	91	EG&G	600	1,406.3	68.7	1,406.3	68.7	20.7%	18.0%
79	69	Contel	595	2,963.7	311.6	2,964.0	312.0	19.8%	8.0%
80	105	LPL Investment Group	585	585.4	9.3	585.4	9.3	20.9%	1.7%
81	79	Medtronic	571	733.0	95.0	653.3	86.5	21.9%	19.0%
82	90	Molex	550	549.6	56.3	502.4	59.3	15.2%	14.9%
83	87	Raychem	529	1,102.7	102.8	1,094.7	125.3	17.3%	14.8%
84	81	Scientific-Atlanta	510	509.8	31.8	508.6	29.7	12.5%	12.3%
85	89	Sprague Technologies	505	504.6	13.2	504.6	13.2	4.0%	3.4%
86	108	Marshall Industries	495	494.5	21.7	420.4	17.6	29.0%	16.2%
87	95	Wyse Technology	489	488.7	-6.9	456.6	28.0	17.0%	9.9%
88	94	Lotus Development	469	468.5	58.9	468.5	58.9	25.4%	17.5%
89	99	Teradyne	462	462.3	-3.3	462.3	-3.3	-1.2%	-0.9%
90	122	AST Research	461	460.7	4.3	412.7	15.1	13.1%	8.1%
91	82	Atari	452	452.2	39.4	452.2	39.4	47.3%	22.3%
92	97	Analog Devices	452	452.1	41.1	439.2	38.0	11.1%	10.2%
93	109	MAI Basic Four	443	443.2	24.3	420.8	24.5	27.6%	8.2%
94	102	Dover	428	1,953.8	145.8	1,953.8	145.8	19.7%	14.7%
95	116	Mark IV Industries	410	569.7	22.7	403.0	17.0	18.4%	3.1%
96	107	Nashua	410	989.4	32.5	989.4	32.5	14.3%	10.2%
97	88	M/A-COM	409	409.3	16.3	424.2	18.4	8.5%	5.7%
98	126	AVX	409	408.9	27.6	408.9	27.6	13.2%	8.2%
99	162	Applied Materials	405	405.5	47.8	362.8	40.0	19.9%	18.0%
100	83	United Telecommunications	400	6,493.0	141.8	6,493.0	141.8	7.6%	2.5%

NA = not available
NM = not meaningful

Fiscal year 1988				Five-year growth (Compounded average annual growth rate)					
Cost of goods as a percentage of revenue	R&D as a percentage of revenue	Revenue per employee ($ thousands)	Net income per employee ($ thousands)	Revenue	Net income	Capital outlays to net cash flow after dividends	Debt as a percentage of total capital	Foreign revenue as a percentage of total revenue	Fiscal year ended
67.9%	3.2%	$75.0	$4.3	4.8%	-8.7%	46.2%	24.1%	10.8%	2/88
65.7%	6.9%	99.2	2.4	10.1%	-9.1%	69.2%	9.9%	40.2%	9/88
79.2%	4.3%	92.9	3.7	6.9%	6.2%	74.7%	36.5%	16.7%	12/88
45.2%	18.5%	76.0	1.3	25.7%	-1.6%	56.7%	27.5%	18.1%	12/88
56.9%	4.5%	105.2	5.4	36.0%	22.9%	38.6%	57.2%	11.2%	3/88
NA	3.6%	130.0	-0.7	12.2%	NM	165.6%	50.5%	0.0%	12/88
51.9%	8.5%	106.2	5.5	2.8%	3.6%	94.9%	24.7%	48.7%	7/88
71.9%	5.2%	96.4	3.5	6.2%	5.2%	88.1%	16.5%	46.2%	12/88
77.7%	0.0%	362.7	3.5	12.2%	13.8%	32.5%	48.0%	0.0%	12/88
73.8%	2.2%	80.7	8.9	3.5%	5.2%	151.1%	20.9%	10.7%	12/88
87.0%	0.5%	114.0	2.7	10.1%	-4.8%	72.5%	52.2%	4.8%	12/88
66.7%	8.8%	116.7	6.5	72.6%	96.3%	50.1%	32.4%	67.3%	6/88
48.4%	11.5%	158.7	22.8	64.9%	79.4%	11.8%	19.4%	39.4%	3/88
NA	0.0%	86.7	2.1	33.6%	23.6%	110.3%	58.3%	27.4%	6/88
77.6%	1.7%	107.3	3.6	18.5%	10.9%	115.2%	35.1%	16.9%	9/88
59.2%	7.7%	102.8	5.2	-0.3%	NM	35.7%	52.6%	32.5%	12/88
69.2%	3.5%	91.4	6.0	8.4%	23.6%	66.1%	37.8%	29.6%	12/88
43.4%	11.1%	109.6	12.1	26.0%	6.9%	54.3%	0.7%	28.7%	12/88
68.5%	6.6%	92.2	1.3	2.2%	-22.4%	106.5%	52.2%	25.8%	12/88
32.7%	10.4%	114.2	5.5	10.9%	-14.0%	135.2%	47.4%	44.5%	12/88
22.2%	15.6%	144.4	29.9	34.8%	43.1%	29.5%	14.9%	34.5%	12/88
93.3%	0.0%	1,041.2	-17.1	50.3%	NM	-75.4%	66.9%	0.0%	3/88
22.3%	11.8%	211.5	44.4	63.8%	80.4%	51.2%	5.1%	47.8%	6/88
65.9%	1.5%	83.7	3.8	10.4%	8.5%	62.7%	43.8%	37.0%	12/88
51.3%	11.8%	147.0	0.1	52.0%	-55.5%	141.7%	38.9%	56.6%	12/88
52.8%	7.8%	181.7	13.0	5.7%	9.9%	60.8%	34.1%	43.1%	12/88
NA	NA	NA	NA	NA	NA	NA	NA	NA	12/88
79.2%	1.4%	56.3	2.7	8.6%	7.9%	36.6%	12.9%	7.6%	12/88
24.5%	0.0%	128.9	13.6	5.4%	13.0%	129.8%	59.9%	0.0%	12/88
60.1%	1.6%	89.9	1.4	NA	NA	15.5%	91.7%	26.9%	12/88
27.7%	8.1%	111.2	14.7	13.4%	10.6%	33.0%	13.2%	31.9%	4/88
43.9%	5.3%	85.1	10.0	23.3%	21.9%	68.5%	2.0%	71.1%	6/88
39.9%	7.7%	100.4	11.5	13.4%	32.6%	44.9%	14.6%	60.6%	6/88
65.2%	5.9%	147.6	8.6	9.3%	140.3%	25.1%	1.4%	14.0%	6/88
72.8%	5.0%	61.5	1.6	3.3%	-10.9%	80.7%	16.0%	39.3%	12/88
75.0%	0.0%	280.3	11.8	9.6%	25.3%	55.1%	44.2%	0.0%	5/88
68.3%	5.3%	109.0	6.7	73.3%	90.1%	59.5%	41.5%	24.1%	3/88
11.4%	17.9%	187.4	23.6	54.6%	33.8%	57.4%	31.0%	34.0%	12/88
50.8%	13.4%	98.4	-0.7	13.0%	NM	75.9%	21.0%	45.7%	12/88
70.1%	3.8%	229.3	8.4	100.6%	56.5%	67.9%	38.1%	20.9%	6/88
61.6%	4.7%	254.0	22.1	NA	NA	6.0%	52.9%	70.5%	12/88
37.4%	13.8%	82.1	7.1	15.5%	15.6%	63.4%	8.4%	33.2%	10/88
46.6%	2.6%	94.1	5.5	NA	NA	63.5%	70.3%	62.3%	9/88
66.0%	0.0%	95.7	7.1	14.1%	13.5%	104.7%	25.2%	15.9%	12/88
59.6%	2.3%	79.0	3.3	79.6%	78.6%	31.9%	82.9%	14.6%	2/88
64.4%	0.8%	137.2	4.5	11.8%	32.4%	61.5%	28.5%	48.7%	12/88
59.7%	5.9%	65.8	2.8	1.3%	-3.6%	58.8%	32.8%	19.6%	9/88
64.6%	2.7%	77.2	5.2	20.5%	26.0%	61.0%	38.1%	43.0%	12/88
49.8%	12.0%	205.5	22.7	28.0%	51.0%	38.5%	9.8%	55.8%	10/88
82.5%	0.0%	172.4	3.8	20.9%	-8.3%	168.5%	67.1%	0.0%	12/88

(Continued)

THE ELECTRONIC BUSINESS 200

FINANCIAL TABLES: 101-150

Rank 1988	Rank 1987	Company	Calendar year 1988 Electronics revenue ($ millions)	Calendar year 1988 Total revenue ($ millions)	Calendar year 1988 Net income ($ millions)	Fiscal year 1988 Total revenue ($ millions)	Fiscal year 1988 Net income ($ millions)	Return on equity	Return on investment
101	112	**Penn Central**	$400	$1,546.5	$94.1	$1,546.5	$94.1	5.3%	4.9%
102	104	**Dynatech**	399	398.7	25.0	367.8	24.5	16.1%	12.1%
103	176	**Oracle Systems**	395	394.9	56.3	282.1	42.9	31.9%	29.3%
104	93	**LTV**	388	7,324.7	-890.6	7,324.7	-890.6	-17.2%	-17.1%
105	137	**LSI Logic**	379	378.9	23.8	378.9	23.8	7.2%	4.3%
106	103	**Diebold**	369	450.6	31.3	450.6	31.3	8.7%	8.5%
107	—	**Micron Technology**	368	367.7	121.7	300.5	98.0	34.0%	31.4%
108	121	**Westmark International**	365	365.3	10.4	365.3	10.4	4.5%	4.3%
109	110	**Dataproducts**	364	364.1	-11.4	345.2	-20.2	-10.8%	-8.5%
110	80	**Corning Glass Works**	363	2,121.5	292.4	2,121.5	210.7	13.5%	10.1%
111	118	**Eli Lilly**	360	4,069.7	761.0	4,069.7	761.0	23.6%	20.3%
112	120	**Premier Industrial**	354	571.0	68.3	535.9	64.0	22.2%	21.7%
113	124	**Micropolis**	353	353.1	-19.4	353.1	-19.4	-16.0%	-9.2%
114	111	**Polaroid**	350	1,862.9	-22.6	1,862.9	-22.6	-2.2%	-1.5%
115	—	**Reliance Electric**	344	1,303.0	27.0	1,303.0	27.0	58.7%	2.9%
116	115	**DSC Communications**	340	339.7	20.0	339.7	20.0	9.3%	6.1%
117	145	**Maxtor**	339	339.0	9.9	271.2	14.1	11.9%	6.0%
118	113	**Datapoint**	335	334.5	6.2	330.8	8.0	4.4%	2.7%
119	—	**Everex Systems**	330	329.9	14.2	266.7	10.5	11.4%	10.5%
120	114	**Augat**	321	321.0	-22.8	321.0	-22.8	-12.5%	-10.8%
121	135	**Wyle Laboratories**	318	410.9	7.8	410.9	7.8	8.3%	5.5%
122	139	**Kollmorgen**	317	344.8	14.1	344.8	14.1	15.8%	8.7%
123	147	**Applied Magnetics**	316	315.7	23.9	293.0	23.7	14.1%	11.1%
124	92	**Textron**	313	7,285.5	272.1	7,285.5	272.1	11.4%	3.3%
125	117	**Cubic**	311	363.8	14.2	364.9	12.2	10.4%	6.4%
126	190	**3Com**	310	309.9	29.3	251.9	22.5	14.4%	14.0%
127	123	**Tandon**	309	309.3	-19.9	309.3	-19.9	-21.2%	-17.7%
128	131	**Foxboro**	308	539.9	9.8	539.9	9.8	5.0%	3.4%
129	132	**Ashton-Tate**	307	307.3	47.8	307.3	47.8	20.5%	20.0%
130	—	**Novell**	307	306.7	34.6	281.2	30.4	22.4%	16.2%
131	125	**Bolt Beranek and Newman**	302	302.1	6.1	305.2	18.1	16.3%	9.0%
132	154	**Mentor Graphics**	301	300.8	33.5	300.8	33.5	15.1%	14.9%
133	—	**Audiovox**	300	320.2	0.3	320.2	0.3	0.4%	0.2%
134	146	**Pioneer-Standard**	299	299.0	7.7	254.6	5.2	15.4%	5.8%
135	136	**Watkins-Johnson**	292	292.2	20.6	292.2	20.6	15.4%	13.0%
136	119	**Genicom**	291	291.4	1.0	291.4	1.0	1.6%	0.6%
137	133	**Savin**	288	360.6	-15.1	360.6	-15.1	-26.6%	-12.3%
138	141	**Gerber Scientific**	288	288.4	31.7	264.0	29.6	17.5%	15.6%
139	127	**Square D**	282	1,656.8	118.9	1,656.8	118.9	18.7%	10.5%
140	130	**Diasonics**	282	281.6	9.8	281.6	9.8	8.4%	6.6%
141	—	**Sequa**	281	1,712.6	71.6	1,712.6	71.5	10.2%	5.2%
142	138	**CTS**	276	275.6	-2.2	275.6	-3.3	-2.8%	-2.3%
143	143	**Bell Industries**	273	430.6	12.2	431.6	12.8	11.0%	9.3%
144	142	**Cooper Industries**	270	4,258.3	224.4	4,258.3	224.4	12.7%	7.4%
145	175	**Combustion Engineering**	270	3,483.9	-245.2	3,483.9	-245.2	-41.3%	-23.8%
146	178	**Stratus Computer**	265	265.3	29.3	265.3	29.3	21.1%	19.3%
147	152	**Measurex**	265	265.2	37.1	265.2	37.1	18.1%	17.6%
148	166	**Anthem Electronics**	265	264.6	11.3	264.6	11.3	14.0%	12.3%
149	134	**Figgie International**	264	1,200.2	61.9	1,203.9	61.9	16.9%	8.8%
150	150	**Andrew**	264	263.9	13.7	253.5	13.9	8.4%	7.2%

NA = not available
NM = not meaningful

Fiscal year 1988				Five-year growth (Compounded average annual growth rate)					
Cost of goods as a percentage of revenue	R&D as a percentage of revenue	Revenue per employee ($ thousands)	Net income per employee ($ thousands)	Revenue	Net income	Capital outlays to net cash flow after dividends	Debt as a percentage of total capital	Foreign revenue as a percentage of total revenue	Fiscal year ended
58.1%	0.6%	$111.3	$6.8	-9.4%	36.7%	28.1%	8.7%	20.2%	12/88
42.6%	9.4%	120.2	8.0	22.3%	20.2%	39.5%	25.0%	28.3%	3/88
57.6%	9.1%	127.8	19.4	123.7%	130.6%	55.4%	8.1%	47.5%	5/88
82.7%	0.0%	188.8	-23.0	9.9%	NM	-63.7%	0.4%	0.0%	12/88
47.8%	9.8%	117.3	7.4	61.2%	19.1%	128.5%	40.6%	38.4%	12/88
66.8%	3.1%	98.8	6.9	0.2%	-8.6%	33.2%	1.6%	8.9%	12/88
33.4%	3.1%	134.8	43.9	87.0%	NM	35.9%	7.6%	31.4%	8/88
52.4%	10.3%	113.2	3.2	12.3%	NM	54.1%	4.0%	28.5%	12/88
69.6%	7.7%	97.3	-5.7	1.7%	NM	-72.1%	22.0%	29.4%	3/88
58.6%	4.5%	80.7	8.0	5.3%	18.0%	87.0%	24.9%	17.4%	12/88
27.8%	13.3%	158.4	29.6	8.3%	10.7%	57.4%	13.8%	37.0%	12/88
50.6%	0.5%	124.6	14.9	11.0%	15.6%	13.3%	2.3%	0.0%	5/88
87.8%	8.0%	110.4	-6.1	46.9%	NM	-1,354.1%	42.6%	69.0%	12/88
49.4%	8.0%	160.4	-1.9	8.2%	NM	661.5%	35.0%	43.7%	12/88
69.8%	0.0%	100.2	2.1	NA	NA	25.8%	95.1%	10.4%	12/88
50.0%	13.2%	122.8	7.2	11.5%	-9.9%	103.0%	34.0%	19.5%	12/88
68.2%	8.8%	86.4	4.5	NA	NA	153.0%	49.3%	16.0%	3/88
48.1%	3.5%	122.8	3.0	-9.3%	-0.2%	82.2%	38.4%	84.5%	7/88
74.7%	5.9%	166.7	6.6	NA	NA	33.0%	7.6%	11.9%	7/88
70.6%	4.1%	89.2	-6.3	6.9%	NM	-147.8%	13.6%	20.4%	12/88
75.9%	0.0%	188.9	3.6	16.0%	NM	93.0%	34.0%	0.0%	1/89
64.0%	4.2%	88.4	3.6	5.8%	9.6%	65.3%	45.0%	23.9%	12/88
67.3%	7.7%	31.0	2.5	23.6%	28.7%	137.8%	21.1%	44.7%	9/88
55.9%	2.3%	121.4	4.5	30.8%	25.1%	55.9%	71.1%	25.6%	12/88
74.6%	1.6%	96.0	3.2	6.0%	-6.7%	50.3%	38.7%	4.6%	9/88
43.2%	9.3%	186.9	16.7	121.3%	331.9%	61.7%	2.3%	27.0%	5/88
77.3%	4.4%	208.5	-13.4	0.4%	NM	-51.7%	16.8%	10.0%	12/88
58.6%	6.9%	101.9	1.9	0.3%	4.2%	67.3%	31.7%	50.9%	12/88
8.3%	17.2%	245.8	38.2	48.2%	55.4%	52.0%	2.4%	39.5%	1/89
40.6%	5.7%	177.5	19.2	118.3%	NM	40.4%	28.0%	32.4%	10/88
55.9%	4.8%	97.2	5.8	29.0%	40.7%	84.9%	44.5%	0.0%	6/88
39.7%	11.2%	176.0	19.6	63.4%	NM	62.6%	1.8%	47.8%	12/88
79.5%	0.0%	291.0	0.3	NA	NA	60.9%	44.5%	0.0%	11/88
75.2%	0.0%	292.6	6.0	16.5%	53.7%	27.5%	62.5%	0.0%	3/88
58.9%	6.3%	92.8	6.5	9.5%	3.0%	39.4%	15.4%	26.0%	12/88
67.7%	3.6%	78.9	0.3	NA	NA	87.3%	63.7%	27.6%	12/88
61.4%	1.0%	178.4	-7.5	-2.2%	-1.5%	23.4%	53.8%	11.9%	12/88
45.5%	6.5%	142.7	16.0	17.7%	45.8%	44.9%	10.6%	53.0%	4/88
62.9%	3.0%	80.8	5.8	8.7%	12.3%	66.0%	43.9%	19.8%	12/88
60.1%	7.2%	169.6	5.9	17.6%	NM	52.8%	22.0%	39.5%	12/88
70.8%	1.0%	107.0	4.5	42.6%	NM	72.8%	49.0%	30.1%	12/88
70.7%	1.6%	43.2	-0.5	5.1%	NM	49.2%	18.0%	19.4%	12/88
74.9%	0.0%	227.2	6.7	14.0%	13.4%	38.8%	15.5%	0.0%	6/88
64.6%	0.0%	92.0	4.8	18.1%	-33.4%	44.5%	41.9%	22.5%	12/88
91.1%	1.6%	120.8	-8.5	8.9%	NM	-51.6%	42.4%	39.5%	12/88
35.0%	11.5%	155.1	17.2	66.8%	68.0%	43.4%	8.5%	28.2%	12/88
49.8%	7.2%	101.2	14.1	16.7%	50.5%	23.5%	2.9%	63.4%	11/88
76.7%	0.0%	529.3	22.6	43.7%	52.7%	5.7%	12.1%	0.0%	12/88
71.0%	1.3%	69.2	3.6	13.4%	21.8%	75.7%	48.1%	0.0%	12/88
59.4%	5.6%	94.6	5.2	7.8%	-4.7%	46.1%	14.5%	53.3%	9/88

(Continued)

THE ELECTRONIC BUSINESS 200

FINANCIAL TABLES: 151-200

Rank 1988	Rank 1987	Company	Calendar year 1988 Electronics revenue ($ millions)	Calendar year 1988 Total revenue ($ millions)	Calendar year 1988 Net income ($ millions)	Fiscal year 1988 Total revenue ($ millions)	Fiscal year 1988 Net income ($ millions)	Return on equity	Return on investment
151	129	Recognition Equipment	$262	$261.5	-$13.1	$260.8	-$12.2	-11.0%	-6.2%
152	140	Bally Manufacturing	260	1,940.8	38.0	1,940.8	38.0	6.5%	1.7%
153	—	Dell Computer	258	257.8	14.4	257.8	14.4	19.2%	13.2%
154	—	Conner Peripherals	257	256.6	19.8	256.6	19.8	18.8%	15.3%
155	128	TIE/communications	255	255.3	-17.0	255.3	-17.0	-14.6%	-11.7%
156	148	Reynolds and Reynolds	250	605.4	21.9	600.1	18.1	9.0%	6.0%
157	—	Management Science America	250	250.0	-33.6	250.0	-33.6	-108.4%	-88.7%
158	144	Ball	245	1,073.0	32.7	1,073.0	32.7	7.8%	5.0%
159	—	Vishay Intertechnology	244	244.4	17.1	109.0	15.5	16.4%	6.9%
160	153	BRIntec	240	337.3	5.7	337.3	5.7	8.7%	3.8%
161	—	Concurrent Computer	240	239.9	-8.1	263.1	14.4	7.4%	6.5%
162	151	Sundstrand	239	1,477.3	-50.1	1,477.3	-50.1	-8.5%	-5.2%
163	185	Inmac	236	236.0	7.6	222.8	9.7	21.5%	17.0%
164	165	Cincinnati Milacron	233	857.8	25.0	857.8	25.0	11.0%	5.8%
165	167	Imo Industries	232	687.2	28.3	687.2	28.3	9.6%	4.8%
166	161	Fluke	232	231.6	13.0	224.5	12.4	9.4%	8.9%
167	158	Logicon	231	231.0	8.9	218.9	9.1	15.0%	15.0%
168	174	Olin	231	2,308.0	98.0	2,308.0	98.0	14.3%	7.4%
169	196	Tyco Laboratories	230	1,792.5	82.0	1,574.6	66.5	22.7%	10.4%
170	164	DCA	226	226.4	26.5	227.5	42.2	20.8%	20.8%
171	188	VLSI Technology	221	221.2	6.7	221.2	6.7	4.5%	2.6%
172	171	Esterline	216	288.5	7.9	284.4	8.4	10.3%	7.9%
173	172	Dynascan	214	213.8	7.2	213.8	7.2	14.6%	8.4%
174	156	Cullinet Software	208	207.8	-42.4	216.7	-47.0	-62.3%	-50.4%
175	187	Cipher Data Products	206	206.5	14.6	185.4	10.4	7.0%	6.9%
176	169	GenRad	206	205.9	-6.2	205.9	-6.2	-9.3%	-4.7%
177	184	Thomas & Betts	206	514.6	58.7	514.6	58.7	18.6%	14.5%
178	106	AM International	205	820.7	8.1	820.7	8.1	3.5%	1.6%
179	—	Fairchild Industries	205	538.7	15.5	550.4	15.5	10.8%	6.2%
180	163	Ultimate	204	203.9	-8.7	209.2	13.0	12.6%	11.8%
181	170	General DataComm	203	203.2	-11.3	192.2	-18.4	-28.8%	-18.5%
182	—	QMS	199	199.2	-4.4	186.7	-5.0	-8.3%	-4.7%
183	186	Oak Industries	198	197.8	12.9	197.8	12.9	14.0%	10.0%
184	—	International Rectifier	195	195.2	-11.2	178.6	-12.1	-41.5%	-6.5%
185	—	Flextronics	194	194.5	-1.5	146.4	5.2	12.6%	8.0%
186	179	Sun Electric	190	190.0	-4.2	190.0	-4.2	-5.6%	-3.5%
187	200	Pittway	190	771.1	37.3	771.1	37.3	11.1%	8.9%
188	189	Coherent	189	188.8	-0.2	188.1	-1.3	-1.6%	-1.3%
189	194	Cherry Electrical	186	210.9	7.4	194.6	7.4	10.4%	6.6%
190	—	LTX	182	182.2	-0.4	174.8	7.0	11.4%	8.5%
191	—	Becton, Dickinson	178	1,749.1	160.4	1,709.4	148.9	15.5%	9.0%
192	—	Chips & Technologies	178	177.9	25.4	141.5	22.1	33.2%	31.3%
193	—	Burr-Brown	177	176.7	11.5	176.7	11.5	15.1%	11.1%
194	182	ADC Telecommunications	175	175.3	15.6	179.9	17.0	18.1%	17.5%
195	198	Brush Wellman	173	345.8	32.5	345.8	32.5	14.0%	11.4%
196	181	Quantum	172	172.5	-2.4	188.5	-3.2	-2.8%	-2.8%
197	—	Rexon	171	171.2	9.9	155.5	9.0	13.1%	11.3%
198	—	Integrated Device Technology	170	170.4	18.0	121.1	11.6	13.4%	10.1%
199	—	Aydin	170	169.7	8.4	169.7	8.4	11.0%	9.2%
200	—	Ask Computer Systems	168	168.3	12.2	142.4	10.8	11.8%	11.4%

NA = not available
NM = not meaningful

Fiscal year 1988				Five-year growth (Compounded average annual growth rate)					
Cost of goods as a percentage of revenue	R&D as a percentage of revenue	Revenue per employee ($ thousands)	Net income per employee ($ thousands)	Revenue	Net income	Capital outlays to net cash flow after dividends	Debt as a percentage of total capital	Foreign revenue as a percentage of total revenue	Fiscal year ended
55.8%	3.3%	$96.3	-$4.5	17.4%	NM	87.5%	43.8%	56.3%	10/88
63.2%	0.7%	149.3	2.9	17.9%	NM	131.2%	74.2%	0.0%	12/88
67.7%	2.8%	214.8	12.0	NA	NA	40.0%	31.2%	15.4%	1/89
76.6%	3.4%	88.6	6.8	NA	NA	122.5%	18.6%	21.6%	12/88
64.5%	5.7%	170.2	-11.3	-4.7%	NM	-44.2%	19.9%	30.0%	12/88
58.1%	2.1%	120.6	3.6	18.9%	8.7%	61.6%	32.7%	10.3%	9/88
NA	23.6%	105.5	-14.2	16.3%	NM	-25.9%	18.2%	23.7%	12/88
80.8%	1.2%	151.1	4.6	3.2%	-3.6%	190.5%	35.6%	0.0%	12/88
58.8%	2.9%	NA	NA	20.9%	28.5%	4.3%	57.9%	65.1%	6/88
78.8%	1.3%	86.5	1.5	5.6%	NA	39.4%	56.3%	16.7%	12/88
46.8%	12.2%	76.3	4.2	4.2%	18.3%	72.8%	11.9%	40.4%	6/88
63.1%	7.8%	107.0	-3.6	10.2%	NM	685.0%	35.2%	24.5%	12/88
62.2%	0.0%	327.7	14.3	NA	NA	34.0%	20.9%	51.4%	7/88
72.2%	4.1%	102.5	3.0	71.9%	17.7%	66.5%	47.1%	19.2%	12/88
66.2%	1.4%	89.2	3.7	11.9%	10.1%	56.8%	49.8%	26.6%	12/88
45.8%	10.4%	93.6	5.2	5.4%	5.3%	68.2%	4.8%	33.4%	9/88
81.9%	0.9%	86.6	3.6	16.2%	15.6%	35.9%	0.0%	0.0%	3/88
72.4%	2.5%	140.7	6.0	6.2%	10.3%	85.0%	48.6%	16.9%	12/88
75.1%	0.4%	131.2	5.5	22.4%	25.4%	42.7%	53.9%	7.8%	5/88
29.7%	11.3%	158.7	29.5	59.9%	82.9%	26.5%	0.0%	22.0%	6/88
44.7%	9.6%	135.7	4.1	43.9%	NM	149.4%	42.3%	29.8%	12/88
58.5%	5.7%	94.2	2.8	8.7%	6.6%	38.2%	23.5%	40.7%	10/88
74.8%	0.9%	482.7	16.4	4.3%	-3.8%	15.8%	42.5%	2.0%	12/88
81.7%	24.2%	90.3	-19.6	20.7%	NM	-29.8%	19.2%	32.6%	4/88
65.2%	9.4%	90.2	5.1	26.6%	-1.2%	27.8%	1.6%	39.1%	6/88
38.3%	14.9%	103.0	-3.1	-1.9%	NM	119.1%	49.4%	31.3%	12/88
48.0%	3.4%	109.5	12.5	11.3%	16.1%	95.2%	22.4%	42.2%	12/88
63.6%	2.6%	108.9	1.1	5.8%	NM	108.4%	53.0%	43.2%	7/88
71.6%	2.1%	110.3	3.1	67.0%	11.3%	120.7%	42.6%	0.0%	12/88
52.2%	2.6%	283.4	17.6	39.8%	23.0%	39.3%	6.4%	33.2%	4/88
51.4%	12.1%	80.1	-7.7	17.6%	NM	-193.8%	35.6%	23.9%	9/88
71.7%	3.1%	196.3	-5.2	66.5%	NM	-500.8%	43.3%	35.0%	9/88
75.3%	1.6%	52.4	3.4	-0.5%	NM	38.9%	28.4%	15.4%	12/88
67.6%	4.3%	77.7	-5.3	15.1%	NM	-8,571.5%	84.4%	43.5%	6/88
83.2%	0.0%	52.9	1.9	82.6%	80.3%	83.6%	36.8%	59.4%	3/88
52.0%	2.8%	77.7	-1.7	4.6%	NM	347.8%	38.3%	44.0%	12/88
60.0%	2.3%	98.9	4.8	12.6%	7.2%	87.7%	20.0%	24.2%	12/88
58.7%	10.5%	110.8	-0.8	15.6%	NM	159.0%	18.0%	38.4%	9/88
62.4%	5.7%	68.7	2.6	17.3%	18.5%	92.2%	36.4%	55.9%	2/88
41.8%	18.1%	123.9	4.9	28.3%	22.8%	89.4%	25.5%	49.2%	7/88
47.1%	5.5%	83.0	7.2	10.6%	36.1%	121.6%	41.8%	37.6%	9/88
47.6%	13.2%	459.3	71.7	NA	NA	27.1%	5.7%	56.0%	6/88
39.5%	8.3%	120.1	7.9	21.8%	21.8%	83.1%	26.8%	69.1%	12/88
49.1%	9.7%	107.1	10.1	18.7%	25.4%	51.7%	3.3%	14.5%	10/88
63.4%	1.9%	132.9	12.5	10.5%	13.4%	54.6%	18.5%	24.3%	12/88
71.4%	6.4%	371.1	-6.4	35.2%	NM	28.8%	0.0%	22.0%	3/88
66.0%	4.7%	133.3	7.7	NA	NA	47.8%	13.5%	35.1%	9/88
34.8%	15.5%	91.2	8.7	NA	NA	110.8%	24.9%	20.0%	3/88
68.4%	5.0%	84.8	4.2	2.1%	-9.7%	26.8%	16.7%	19.7%	12/88
42.9%	8.3%	206.7	15.7	29.3%	22.6%	31.2%	3.5%	12.7%	6/88

(Continued)

THE ELECTRONIC BUSINESS 200

INDUSTRY SEGMENTS

Fiscal 1988 figures Company	Revenue per employee ($ thousands)	Profit as a percentage of revenue	Return on investment	Cost of goods sold as a percentage of revenue	R&D as a percentage of revenue	Capital expenditures as a percentage of revenue	Foreign revenue as a percentage of revenue	200 rank
Mainframes								
Amdahl	$217.1	11.9%	18.5%	47.5%	12.3%	15.5%	43.2%	40
IBM	154.2	9.2%	10.4%	35.0%	9.9%	9.0%	57.6%	1
Cray Research	144.4	20.7%	19.7%	22.2%	15.6%	10.8%	34.5%	71
Control Data	108.3	0.1%	0.1%	64.2%	9.3%	4.7%	29.8%	19
Unisys	106.5	6.9%	8.0%	49.4%	7.2%	6.8%	45.8%	7
NCR	99.8	7.3%	16.1%	48.5%	7.0%	7.0%	58.3%	12
Weighted average	**$139.2**	**8.5%**	**10.3%**	**39.2%**	**9.5%**	**8.6%**	**54.4%**	
Minicomputers								
Stratus Computer	$155.1	11.1%	19.3%	35.0%	11.5%	6.7%	28.2%	146
IBM	154.2	9.2%	10.4%	35.0%	9.9%	9.0%	57.6%	1
Tandem Computers	152.4	7.2%	9.5%	30.6%	12.9%	14.1%	51.0%	46
Sun Microsystems	148.3	6.3%	12.6%	47.5%	13.3%	11.2%	38.4%	44
Apollo Computer	147.0	0.0%	0.1%	51.3%	11.8%	9.2%	56.6%	75
Prime Computer	128.7	0.8%	1.8%	40.7%	10.9%	8.8%	56.6%	43
Hewlett-Packard	113.0	8.3%	16.0%	44.3%	10.4%	6.6%	51.6%	6
MAI Basic Four	94.1	5.8%	8.2%	46.6%	2.6%	3.9%	62.3%	93
Digital Equipment	91.4	11.4%	16.8%	43.1%	11.4%	13.2%	49.9%	3
Data General	88.5	-1.1%	-2.2%	43.1%	12.1%	7.1%	46.0%	48
Concurrent Computer	76.3	5.5%	6.5%	46.8%	12.2%	7.8%	40.4%	161
Weighted average	**$133.8**	**8.9%**	**11.2%**	**37.6%**	**10.3%**	**9.3%**	**55.3%**	
Microcomputers								
Apple Computer	$377.0	9.8%	35.4%	47.0%	6.7%	3.5%	32.1%	17
Compaq Computer	299.4	12.4%	23.4%	57.3%	3.6%	13.2%	38.6%	37
Atari	254.0	8.7%	22.3%	61.6%	4.7%	0.5%	70.5%	91
AST Research	229.3	3.7%	8.1%	70.1%	3.8%	3.5%	20.9%	90
Dell Computer	214.8	5.6%	13.2%	67.7%	2.8%	2.6%	15.4%	153
Tandon	208.5	-6.4%	-17.7%	77.3%	4.4%	2.6%	10.0%	127
Everex Systems	166.7	3.9%	10.5%	74.7%	5.9%	1.6%	11.9%	119
IBM	154.2	9.2%	10.4%	35.0%	9.9%	9.0%	57.6%	1
Tandy	102.5	8.3%	15.3%	47.5%	0.0%	2.5%	1.8%	18
Zenith Electronics	74.6	0.2%	0.6%	82.3%	3.7%	1.2%	17.9%	28
Weighted average	**$152.4**	**8.8%**	**11.1%**	**39.4%**	**8.7%**	**8.1%**	**50.7%**	
Computer-based systems								
Ask Computer Systems	$206.7	7.6%	11.4%	42.9%	8.3%	3.8%	12.7%	200
Mentor Graphics	176.0	11.2%	14.9%	39.7%	11.2%	9.7%	47.8%	132
Gerber Scientific	142.7	11.2%	15.6%	45.5%	6.5%	5.8%	53.0%	138
Hewlett-Packard	113.0	8.3%	16.0%	44.3%	10.4%	6.6%	51.6%	6
Coherent	110.8	-0.7%	-1.3%	58.7%	10.5%	4.8%	38.4%	188
Intergraph	109.6	11.0%	13.1%	43.4%	11.1%	8.3%	28.7%	68
Measurex	101.2	14.0%	17.6%	49.8%	7.2%	3.9%	63.4%	147
Recognition Equipment	96.3	-4.7%	-6.2%	55.8%	3.3%	3.5%	56.3%	151
Sun Electric	77.7	-2.2%	-3.5%	52.0%	2.8%	2.6%	44.0%	186
Weighted average	**$113.3**	**8.1%**	**14.4%**	**44.9%**	**10.0%**	**6.5%**	**49.6%**	

For purposes of comparison, only companies whose electronics revenue constitutes over 70% of total revenue are included

THE ELECTRONIC BUSINESS 200

INDUSTRY SEGMENTS

Fiscal 1988 figures Company	Revenue per employee ($ thousands)	Profit as a percentage of revenue	Return on investment	Cost of goods sold as a percentage of revenue	R&D as a percentage of revenue	Capital expenditures as a percentage of revenue	Foreign revenue as a percentage of revenue	200 rank
Semiconductors								
Chips & Technologies	$459.3	15.6%	31.3%	47.6%	13.2%	4.6%	56.0%	192
Intel	138.2	15.8%	16.3%	45.0%	11.1%	16.6%	42.9%	25
VLSI Technology	135.7	3.0%	2.6%	44.7%	9.6%	24.9%	29.8%	171
Micron Technology	134.8	32.6%	31.4%	33.4%	3.1%	14.7%	31.4%	107
Burr-Brown	120.1	6.5%	11.1%	39.5%	8.3%	12.1%	69.1%	193
LSI Logic	117.3	6.3%	4.3%	47.8%	9.8%	26.6%	38.4%	105
Western Digital	116.7	5.6%	11.4%	66.7%	8.8%	4.7%	67.3%	62
Integrated Device Technology	91.2	9.6%	10.1%	34.8%	15.5%	23.0%	20.0%	198
Texas Instruments	83.2	5.8%	12.7%	70.3%	7.8%	10.0%	32.3%	11
Analog Devices	82.1	8.6%	10.2%	37.4%	13.8%	10.8%	33.2%	92
Motorola	80.9	5.4%	9.4%	54.5%	8.1%	10.6%	48.1%	9
International Rectifier	77.7	-6.8%	-6.5%	67.6%	4.3%	7.2%	43.5%	184
Advanced Micro Devices	76.0	1.7%	2.7%	45.2%	18.5%	8.7%	18.1%	54
National Semiconductor	65.5	2.5%	5.9%	63.3%	11.3%	8.1%	45.2%	30
Weighted average	**$86.2**	**6.7%**	**10.9%**	**57.5%**	**9.4%**	**11.1%**	**41.4%**	
Capital equipment								
Applied Materials	$205.5	11.0%	18.0%	49.8%	12.0%	5.5%	55.8%	99
Gerber Scientific	142.7	11.2%	15.6%	45.5%	6.5%	5.8%	53.0%	138
LTX	123.9	4.0%	8.5%	41.8%	18.1%	10.3%	49.2%	190
Hewlett-Packard	113.0	8.3%	16.0%	44.3%	10.4%	6.6%	51.6%	6
Perkin-Elmer	106.2	5.1%	6.3%	51.9%	8.5%	7.2%	48.7%	57
GenRad	103.0	-3.0%	-4.7%	38.3%	14.9%	6.0%	31.3%	176
Varian Associates	99.2	2.4%	5.5%	65.7%	6.9%	3.7%	40.2%	52
Teradyne	98.4	-0.7%	-0.9%	50.8%	13.4%	4.3%	45.7%	89
Esterline	94.2	2.9%	7.9%	58.5%	5.7%	2.3%	40.7%	172
Fluke	93.6	5.5%	8.9%	45.8%	10.4%	7.0%	33.4%	166
Tektronix	87.8	-1.2%	-2.3%	42.8%	15.3%	5.5%	44.4%	45
Sun Electric	77.7	-2.2%	-3.5%	52.0%	2.8%	2.6%	44.0%	186
Weighted average	**$106.3**	**6.2%**	**11.2%**	**46.9%**	**10.4%**	**6.1%**	**49.0%**	
Peripherals								
Quantum	$371.1	-1.7%	-2.8%	71.4%	6.4%	1.6%	22.0%	196
AST Research	229.3	3.7%	8.1%	70.1%	3.8%	3.5%	20.9%	90
QMS	196.3	-2.7%	-4.7%	71.7%	3.1%	2.0%	35.0%	182
Everex Systems	166.7	3.9%	10.5%	74.7%	5.9%	1.6%	11.9%	119
Rexon	133.3	5.8%	11.3%	66.0%	4.7%	3.5%	35.1%	197
Micropolis	110.4	-5.5%	-9.2%	87.8%	8.0%	18.1%	69.0%	113
Wyse Technology	109.0	6.1%	9.9%	68.3%	5.3%	4.6%	24.1%	87
Storage Technology	102.8	5.1%	7.4%	59.2%	7.7%	5.4%	32.5%	66
Dataproducts	97.3	-5.9%	-8.5%	69.6%	7.7%	2.1%	29.4%	109
Cipher Data Products	90.2	5.6%	6.9%	65.2%	9.4%	2.5%	39.1%	175
Conner Peripherals	88.6	7.7%	15.3%	76.6%	3.4%	11.8%	21.6%	154
Maxtor	86.4	5.2%	6.0%	68.2%	8.8%	14.1%	16.0%	117
Genicom	78.9	0.3%	0.6%	67.7%	3.6%	4.2%	27.6%	136
Seagate Technology	41.9	6.2%	10.4%	78.0%	4.0%	22.6%	40.5%	47
Applied Magnetics	31.0	8.1%	11.1%	67.3%	7.7%	18.9%	44.7%	123
Weighted average	**$75.6**	**3.5%**	**5.8%**	**71.0%**	**5.8%**	**10.3%**	**33.0%**	

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THE ELECTRONIC BUSINESS 200

INDUSTRY SEGMENTS

Fiscal 1988 figures Company	Revenue per employee ($ thousands)	Profit as a percentage of revenue	Return on investment	Cost of goods sold as a percentage of revenue	R&D as a percentage of revenue	Capital expenditures as a percentage of revenue	Foreign revenue as a percentage of revenue	200 rank
Software								
Ultimate	$283.4	6.2%	11.8%	52.2%	2.6%	4.2%	33.2%	180
Ashton-Tate	245.8	15.5%	20.0%	8.3%	17.2%	11.8%	39.5%	129
Microsoft	211.5	21.0%	31.3%	22.3%	11.8%	12.1%	47.8%	73
Lotus Development	187.4	12.6%	17.5%	11.4%	17.9%	11.8%	34.0%	88
Computer Associates	158.7	14.4%	16.4%	48.4%	11.5%	2.7%	39.4%	63
Oracle Systems	127.8	15.2%	29.3%	57.6%	9.1%	11.0%	47.5%	103
Management Science America	105.5	-13.4%	-88.7%	-4.8%	23.6%	2.2%	23.7%	157
Cullinet Software	90.3	-21.7%	-50.4%	81.7%	24.2%	3.2%	32.6%	174
Weighted average	**$162.0**	**10.1%**	**15.5%**	**32.7%**	**14.2%**	**7.7%**	**38.7%**	
Communications								
Dynascan	$482.7	3.4%	8.4%	74.8%	0.9%	0.7%	2.0%	173
Inmac	327.7	4.4%	17.0%	62.2%	0.0%	1.7%	51.4%	163
3Com	186.9	8.9%	14.0%	43.2%	9.3%	7.5%	27.0%	126
Novell	177.5	10.8%	16.2%	40.6%	5.7%	5.5%	32.4%	130
TIE/communications	170.2	-6.6%	-11.7%	64.5%	5.7%	1.9%	30.0%	155
DCA	158.7	18.6%	20.8%	29.7%	11.3%	6.0%	22.0%	170
Scientific-Atlanta	147.6	5.8%	12.3%	65.2%	5.9%	2.0%	14.0%	84
Datapoint	122.8	2.4%	2.7%	48.1%	3.5%	5.9%	84.5%	118
DSC Communications	122.8	5.9%	6.1%	50.0%	13.2%	13.5%	19.5%	116
Dynatech	120.2	6.7%	12.1%	42.6%	9.4%	4.1%	28.3%	102
ADC Telecommunications	107.1	9.4%	17.5%	49.1%	9.7%	7.5%	14.5%	194
Bolt Beranek and Newman	97.2	5.9%	9.0%	55.9%	4.8%	9.4%	0.0%	131
Andrew	94.6	5.5%	7.2%	59.4%	5.6%	5.1%	53.3%	150
Motorola	80.9	5.4%	9.4%	54.5%	8.1%	10.6%	48.1%	9
General DataComm	80.1	-9.6%	-18.5%	51.4%	12.1%	4.5%	23.9%	181
General Instrument	75.0	5.7%	9.1%	67.9%	3.2%	5.2%	10.8%	51
Weighted average	**$91.2**	**5.4%**	**9.0%**	**55.2%**	**7.3%**	**8.6%**	**39.2%**	
Consumer								
Emerson Radio	$1,041.2	-1.6%	-5.1%	93.3%	0.0%	0.9%	0.0%	72
Audiovox	291.0	0.1%	0.2%	79.5%	0.0%	0.3%	0.0%	133
Tandy	102.5	8.3%	15.3%	47.5%	0.0%	2.5%	1.8%	18
Zenith Electronics	74.6	0.2%	0.6%	82.3%	3.7%	1.2%	17.9%	28
Weighted average	**$100.6**	**4.1%**	**9.3%**	**65.7%**	**1.3%**	**1.8%**	**7.3%**	
Office equipment								
Savin	$178.4	-4.2%	-12.3%	61.4%	1.0%	0.3%	11.9%	137
IBM	154.2	9.2%	10.4%	35.0%	9.9%	9.0%	57.6%	1
Xerox	114.6	0.6%	0.5%	43.5%	6.9%	4.4%	49.5%	5
NCR	99.8	7.3%	16.1%	48.5%	7.0%	7.0%	58.3%	12
Wang Laboratories	99.3	3.0%	4.1%	40.3%	8.0%	8.9%	46.2%	22
Diebold	98.8	7.0%	8.5%	66.8%	3.1%	1.8%	8.9%	106
Harris	92.9	3.1%	5.8%	60.5%	5.6%	3.9%	15.0%	36
Pitney Bowes	90.4	8.9%	6.5%	27.3%	3.0%	11.7%	21.0%	38
Weighted average	**$134.7**	**7.5%**	**8.4%**	**37.9%**	**8.9%**	**8.2%**	**53.5%**	

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THE ELECTRONIC BUSINESS 200

INDUSTRY SEGMENTS

Fiscal 1988 figures Company	Revenue per employee ($ thousands)	Profit as a percentage of revenue	Return on investment	Cost of goods sold as a percentage of revenue	R&D as a percentage of revenue	Capital expenditures as a percentage of revenue	Foreign revenue as a percentage of revenue	200 rank
Government								
GM Hughes Electronics	$115.9	5.6%	7.4%	70.7%	4.9%	4.7%	12.3%	4
Loral	105.2	5.2%	7.3%	56.9%	4.5%	3.5%	11.2%	55
Varian Associates	99.2	2.4%	5.5%	65.7%	6.9%	3.7%	40.2%	52
Cubic	96.0	3.4%	6.4%	74.6%	1.6%	2.7%	4.6%	125
Harris	92.9	3.1%	5.8%	60.5%	5.6%	3.9%	15.0%	36
Watkins-Johnson	92.8	7.0%	13.0%	58.9%	6.3%	4.0%	26.0%	135
Honeywell	91.2	-6.1%	-15.3%	71.9%	4.5%	4.6%	22.9%	10
Litton Industries	88.4	3.4%	6.1%	74.2%	4.7%	4.7%	26.9%	21
SCI Systems	86.7	2.4%	5.2%	-2.6%	0.0%	5.5%	27.4%	64
Logicon	86.6	4.1%	15.0%	81.9%	0.9%	1.7%	0.0%	167
E-Systems	86.3	5.2%	12.5%	63.1%	NA	3.7%	10.4%	50
Aydin	84.8	4.9%	9.2%	68.4%	5.0%	2.1%	19.7%	199
Texas Instruments	83.2	5.8%	12.7%	70.3%	7.8%	10.0%	32.3%	11
Motorola	80.9	5.4%	9.4%	54.5%	8.1%	10.6%	48.1%	9
M/A-COM	65.8	4.3%	5.7%	59.7%	5.9%	5.5%	19.6%	97
Weighted average	**$92.4**	**3.3%**	**5.7%**	**65.7%**	**6.2%**	**6.3%**	**25.7%**	
Medical								
Diasonics	$169.6	3.5%	6.6%	60.1%	7.2%	3.7%	39.5%	140
Westmark International	113.2	2.9%	4.3%	52.4%	10.3%	3.1%	28.5%	108
Medtronic	111.2	13.2%	19.0%	27.7%	8.1%	5.1%	31.9%	81
Weighted average	**$120.8**	**8.2%**	**12.6%**	**41.7%**	**8.6%**	**4.3%**	**32.6%**	
Components								
AMP	$112.0	11.8%	18.3%	56.1%	8.8%	8.2%	53.6%	33
LPL Investment Group	89.9	1.6%	1.7%	60.1%	1.6%	1.2%	26.9%	80
Augat	89.2	-7.1%	-10.8%	70.6%	4.1%	5.5%	20.4%	120
BRIntec	86.5	1.7%	3.8%	78.8%	1.3%	1.5%	16.7%	160
Molex	85.1	11.8%	14.9%	43.9%	5.3%	13.7%	71.1%	82
AVX	77.2	6.7%	8.2%	64.6%	2.7%	8.0%	43.0%	98
Cherry Electrical	68.7	3.8%	6.6%	62.4%	5.7%	9.1%	55.9%	189
Sprague Technologies	61.5	2.6%	3.4%	72.8%	5.0%	7.6%	39.3%	85
Oak Industries	52.4	6.5%	10.0%	75.3%	1.6%	3.8%	15.4%	183
CTS	43.2	-1.2%	-2.3%	70.7%	1.6%	3.6%	19.4%	142
Vishay Intertechnology	NA	14.2%	6.9%	58.8%	2.9%	0.8%	65.1%	159
Weighted average	**$87.0**	**7.2%**	**10.2%**	**61.0%**	**5.7%**	**6.9%**	**44.4%**	
Distribution								
Anthem Electronics	$529.3	4.3%	12.3%	76.7%	0.0%	0.3%	0.0%	148
Arrow Electronics	362.7	1.0%	3.4%	77.7%	0.0%	0.5%	0.0%	59
Pioneer-Standard	292.6	2.0%	5.8%	75.2%	0.0%	0.8%	0.0%	134
Marshall Industries	280.3	4.2%	16.2%	75.0%	0.0%	2.6%	0.0%	86
Wyle Laboratories	188.9	1.9%	5.5%	75.9%	0.0%	2.3%	0.0%	121
Avnet	182.9	2.9%	5.7%	73.8%	0.0%	1.4%	0.0%	42
Weighted average	**$234.9**	**2.5%**	**6.3%**	**75.3%**	**0.0%**	**1.3%**	**0.0%**	

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BEST AND WORST PERFORMERS

Net income/sales

(percentage)		200 rank
TOP 10		
Micron Technology	32.6%	107
Microsoft	21.0%	73
Cray Research	20.7%	71
Eli Lilly	18.7%	111
Digital Communications	18.6%	170
Intel	15.8%	25
Chips & Technologies	15.6%	192
Ashton-Tate	15.5%	129
Oracle Systems	15.2%	103
Computer Associates	14.4%	63
MEDIAN	**4.9%**	
BOTTOM 5		
Augat	-7.1%	120
General DataComm	-9.6%	181
LTV	-12.2%	104
MSA	-13.4%	157
Cullinet Software	-21.7%	174

Sales per employee

($ thousands)		200 rank
TOP 10		
Emerson Radio	$1,041.2	72
Anthem Electronics	529.3	148
Dynascan	482.7	173
Chips & Technologies	459.3	192
Apple Computer	377.0	17
Quantum	371.1	196
Arrow Electronics	362.7	59
Inmac	327.7	163
Compaq Computer	299.4	37
Pioneer-Standard	292.6	134
MEDIAN	**$109.5**	
BOTTOM 5		
Flextronics	$52.9	185
Oak Industries	52.4	183
CTS	43.2	142
Seagate Technology	41.9	47
Applied Magnetics	31.0	123

Five-year net income growth

(compound average annual)		200 rank
TOP 10		
3Com	331.9%	126
Sun Microsystems	152.0%	44
Compaq Computer	150.3%	37
Scientific-Atlanta	140.3%	84
Oracle Systems	130.6%	103
Western Digital	96.3%	62
Wyse Technology	90.1%	87
Digital Communications	82.9%	170
Microsoft	80.4%	73
Flextronics	80.3%	185
MEDIAN	**9.6%**	
BOTTOM 5		
General Signal	-22.4%	69
Cooper Industries	-33.4%	144
Zenith Electronics	-35.2%	28
Apollo Computer	-55.5%	75
Control Data	-58.1%	19

Return on equity

(percentage)		200 rank
TOP 10		
Reliance Electric	58.7%	115
Atari	47.3%	91
Apple Computer	39.9%	17
Micron Technology	34.0%	107
Chips & Technologies	33.2%	192
Microsoft	33.0%	73
Oracle Systems	31.9%	103
Compaq Computer	31.3%	37
Marshall Industries	29.0%	86
MAI Basic Four	27.6%	93
MEDIAN	**13.2%**	
BOTTOM 5		
General DataComm	-28.8%	181
Combustion Engineering	-41.3%	145
International Rectifier	-41.5%	184
Cullinet Software	-62.3%	174
MSA	-108.4%	157

Net income per employee

($ thousands)		200 rank
TOP 10		
Chips & Technologies	$71.7	192
Microsoft	44.4	73
Micron Technology	43.9	107
Ashton-Tate	38.2	129
Apple Computer	37.1	17
Compaq Computer	37.0	37
Cray Research	29.9	71
Eli Lilly	29.6	111
Digital Communications	29.5	170
Amdahl	25.8	40
MEDIAN	**$5.2**	
BOTTOM 5		
Tandon	-$13.4	127
MSA	-14.2	157
Emerson Radio	-17.1	72
Cullinet Software	-19.6	174
LTV	-23.0	104

Debt/total capital

(percentage)		200 rank
TOP 10		
Reliance Electric	95.1%	115
LPL Investment Group	91.7%	80
International Rectifier	84.4%	184
Mark IV Industries	82.9%	95
Chrysler	78.2%	49
Ford Motor	76.5%	20
Bally Manufacturing	74.2%	152
Textron	71.1%	124
MAI Basic Four	70.3%	93
Westinghouse Electric	69.8%	29
MEDIAN	**28.5%**	
BOTTOM 5		
Intergraph	0.7%	68
LTV	0.4%	104
Quantum	0.0%	196
Digital Communications	0.0%	170
Logicon	0.0%	167

Return on investment

(percentage)		200 rank
TOP 10		
Apple Computer	35.4%	17
Micron Technology	31.4%	107
Microsoft	31.3%	73
Chips & Technologies	31.3%	192
Oracle Systems	29.3%	103
Compaq Computer	23.4%	37
Atari	22.3%	91
Premier Industrial	21.7%	112
Digital Communications	20.8%	170
Eli Lilly	20.3%	111
MEDIAN	**8.2%**	
BOTTOM 5		
Tandon	-17.7%	127
General DataComm	-18.5%	181
Combustion Engineering	-23.8%	145
Cullinet Software	-50.4%	174
MSA	-88.7%	157

Five-year revenue growth

(compound average annual)		200 rank
TOP 10		
Sun Microsystems	161.2%	44
Oracle Systems	123.7%	103
3Com	121.3%	126
Novell	118.3%	130
AST Research	100.6%	90
Micron Technology	87.0%	107
Flextronics	82.6%	185
Mark IV Industries	79.6%	95
Compaq Computer	79.4%	37
Wyse Technology	73.3%	87
MEDIAN	**12.4%**	
BOTTOM 5		
GenRad	-1.9%	176
Savin	-2.2%	137
TIE/communications	-4.7%	155
Datapoint	-9.3%	118
Penn Central	-9.4%	101

Foreign revenue/total revenue

(percentage)		
TOP 10		
Datapoint	84.5%	118
Molex	71.1%	82
Atari	70.5%	91
Burr-Brown	69.1%	193
Micropolis	69.0%	113
Western Digital	67.3%	62
Vishay Intertechnology	65.1%	159
Measurex	63.4%	147
MAI Basic Four	62.3%	93
Raychem	60.6%	83
MEDIAN	**32.3%**	
BOTTOM 5		
EG&G	7.6%	78
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THE ELECTRONIC BUSINESS 200

ARRIVALS AND DEPARTURES

ARRIVALS	1988 rank
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Xidex[14]	85

[1] acquired by the Bass Group May 17, 1988

[2] acquired by Frametome SA Jan. 10, 1989

[3] merged with Agfa-Gevaert Inc., a unit of Bayer AG June 15, 1988

[4] acquired by Prime Computer Inc. (rank 43) Feb. 5, 1988

[5] acquired by Unisys Corp. (rank 7) Dec. 22, 1988

[6] acquired by Onset Corp. April 29, 1988

[7] acquired by Nippon Mining Co. Nov.1, 1988

[8] acquired by Ing. C. Olivetti & Co. SpA May 5, 1989

[9] acquired by INR Acquisition Corp., a unit of Wagner & Brown Sept. 29, 1988

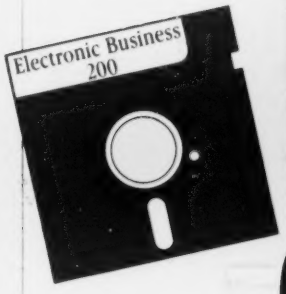
[10] acquired by Odyssey Partners Sept. 15, 1988

[11] acquired by American Telephone & Telegraph Co. Jan. 8, 1989

[12] acquired by Bilzerian Partners L.P.1 April 19, 1988

[13] acquired by VII Merger Corp. a unit of Unitech Plc Feb. 22, 1989

[14] acquired by Anacomp Inc. Aug. 29, 1988



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THE ELECTRONIC BUSINESS 200

ALPHABETICAL INDEX

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High yen, competition leveling global playing field

While the top Japanese electronics companies produced healthy growth in fiscal 1989, their U.S. counterparts — thanks to sharp productivity gains — are catching up fast

BY PAULA DOE

Japan's leading electronics companies have recovered from the wallop of the high yen. Electronics sales for the 20 largest electronics producers grew a healthy 13% in the fiscal year ending March 1989, and margins climbed back up to the levels of the good old pre-1984 days.

But in the current period of high yen and increasing global competition, the big Japanese companies don't have the edge they once did. Their U.S. counterparts are matching their revenue growth and continuing to post sharper productivity gains.

ELECTRONIC BUSINESS tracks the results of Japan's major electronics companies from news releases and financial reports published in Japan and interviews with company officials before the English language annual reports trickle out from many of the companies. Usually our survey provides the first good figures available out of Japan.

Our survey shows that Japan's fabled productivity edge continues to fade. U.S. productivity growth, as approximated by sales per employee, outpaced that of the big Japanese companies for the fourth straight year, climbing 10% while the Japanese figure remained flat.

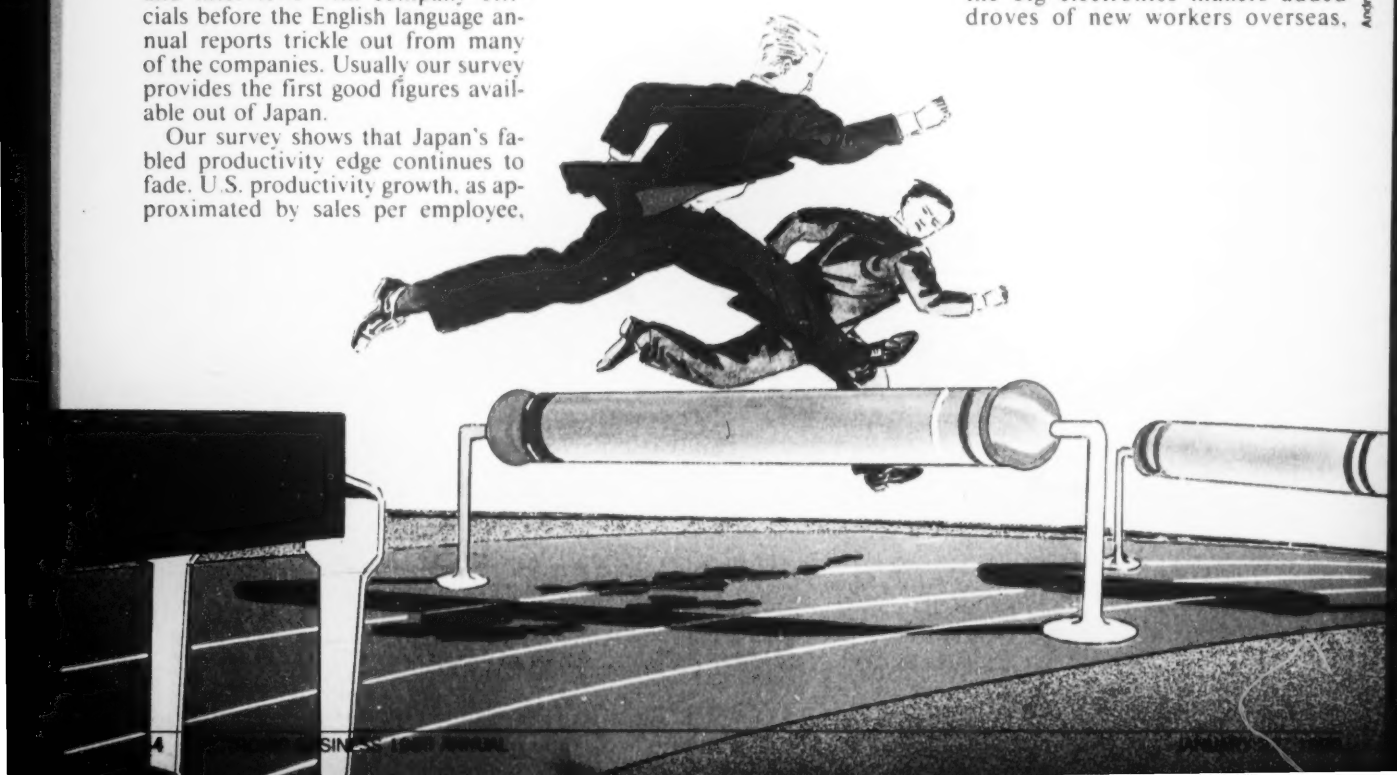
On average, the Japanese still manage to sell more than one and a half times as much per employee as the top U.S. companies. But slow growth over the past several years suggests the Japanese producers may have reached the limit of possible improvement through efficient management, while U.S. companies now adopting similar practices are catching up fast.

When ELECTRONIC BUSINESS began to collect Japanese financial data and compare it with our own ELECTRONIC BUSINESS 200 several years ago, it was rare to find any U.S. companies, other than distributors, with revenue per employee anywhere close to any of the Japanese companies.

This year, however, the leading U.S. companies in almost every segment have revenue per employee above the $185,000 median of the Japanese companies [ELECTRONIC BUSINESS, July 24, 1989]. Many makers of microcomputers, peripherals, software and communications equipment now surpass even the $250,000 level of the best Japanese companies.

Japanese figures are lower

Japanese revenue per employee figures were also lower this year because the big electronics makers added droves of new workers overseas,



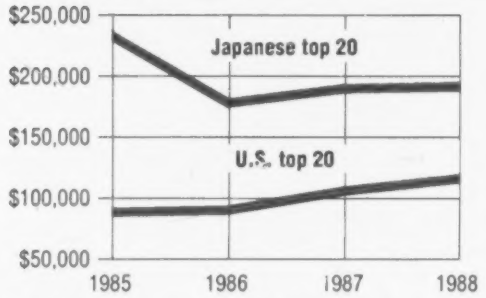
Andrea Baruffi

Japanese versus U.S. electronics companies in 1988

	Japanese top 20	U.S. top 20
Electronics revenue ($ billions)	$195.8	$170.0
Change from 1987	+13.1%	+12.2%
Total revenue ($ billions)	$297.3	$170.7
Change from 1987	+10.6%	+10.7%
Net income ($ billions)	$9.2	$11.8
Change from1987	+43.2%	+2.4%
Net income/sales	3.1%	6.9%
Revenue per employee	$192,000	$116,500
Change from 1987	-0.2%	+10.1%
Net income per employee	$6,300	$8,000
Change from 1987	+49.7%	+1.8%

Conversion rate: ¥130 = $1

Productivity (revenue per employee)



Japanese 1987 figures are recast by 1988 accounting methods; the originally reported 1987 figure was $200,200

Source: ELECTRONIC BUSINESS

without cutting back appreciably at their plants in Japan.

Productivity should improve in the near future as the new plants abroad get fully cranked up and the Japanese workers at home develop new goods with higher value added. But many in Japan suspect that with its new multinational workforce and scattered production sites selected for political rather than economic reasons, the country won't ever regain the productivity edge it once had.

More realistic accounting methods also brought down Japanese productivity figures this year. Japanese revenue per employee numbers have been artificially inflated in the past, because workers at unconsolidated subsidiaries were not being counted even though they contributed directly to making and selling the company's products.

Matsushita Electric Industrial Co. Ltd., Hitachi Ltd. and Sony Corp. all included more subsidiaries in their consolidated financial reports this year. The new standards change reported very little sales and earnings, but they mean big increases in the number of reported employees. We've recast these companies' 1987 results by the same standards for comparison.

Without the advantage of a cheap currency, Japan's leading electronics producers grew at almost exactly the same pace as their U.S. counterparts. Although the Japanese companies have traditionally used aggressive leveraged financing to race after market share and achieve markedly higher rates of growth than U.S. industry growth rates, this year's 13% increase in Japanese electronics revenues was little different from the 12% growth at the top U.S. companies.

The hottest Japanese growth company this year was Sony

Total revenue of the leading electronics companies was up about 11% in both countries.

Contrary to all common assumptions about the lack of potential in the consumer electronics market, the hottest Japanese growth company this year was Sony. Much of the company's 38% increase in revenue came from its successful diversification efforts, including a fat 16% jump from the acquisition of CBS Records Inc.

Sony's sales of nonconsumer electronics products — its semiconductors, floppy disk systems and workstations — grew 22% to account for 15% of total company sales, or about the same as the company's television business. But sales of camcorders and video cassette recorders grew still faster at 27%, and even sales of audio equipment increased a healthy 17%.

Cost cutting

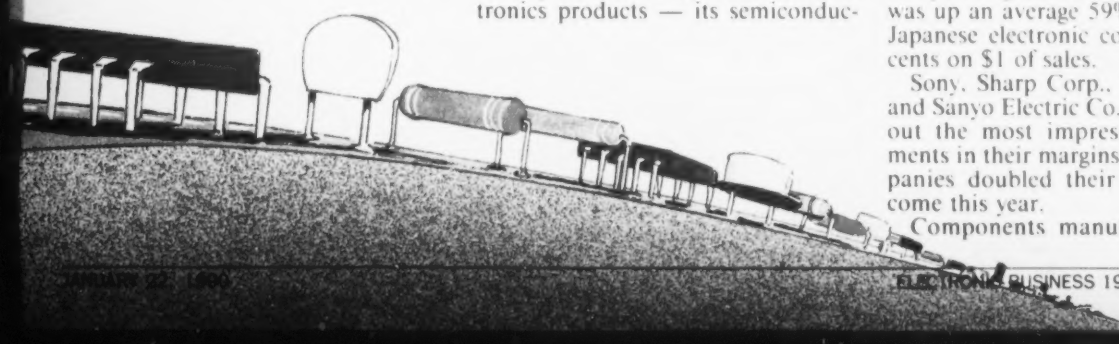
Earnings soared at the Japanese companies, as herculean efforts to cut costs and move up to higher margin products finally took full effect. The big Japanese producers saw their earnings jump 43% overall, compared with a meager 2% growth at the big U.S. companies.

Net income at NEC Corp., Mitsubishi Corp., Canon Inc., and Oki Electric Industries Co. Ltd. more than doubled. This robust Japanese earnings growth brought net income right back up to where it was before the high yen, to about 3% to 4% of sales. That slim margin is only about half the average U.S. figure, but with little pressure to generate income for shareholders, Japanese companies tend to plow their earnings back into growing the business and thus keep net income low.

Probably a better measure of the effectiveness of Japanese cost cutting is operating income. That measure was up an average 59% at the major Japanese electronic companies, to 7 cents on $1 of sales.

Sony, Sharp Corp., Toshiba Corp. and Sanyo Electric Co. Ltd. squeezed out the most impressive improvements in their margins. All four companies doubled their operating income this year.

Components manufacturers who



dominate their niches had the fattest operating margins: Kyocera Corp., 16%; TDK Electronics Co. Ltd., 13%; and Omron Corp., 11%. NTT earned 13% on operations in its still highly regulated telecommunications market.

Canon, moving upscale and overseas fast, managed 8% from copiers, printers, cameras and steppers. Surprisingly, efficient Matsushita and Sony each squeezed respectable operating margins of more than 7% out of consumer electronics. Most of the other big Japanese names in computers and semiconductors earned about 6 to 7 cents on each dollar of operations.

Cost cutting only accounts for part of the recovery in Japanese margins. Companies are also trying hard to move to higher value-added products. Toshiba increased its sales of information and communication equipment and electronic devices from 39% of its total in 1984 to 49% in 1988. Matsushita's sales in the same category climbed from 27% in 1984 to 33% in 1988, Hitachi's from 27% to 32%. □

Japan's top electronics companies in 1988

		Electronics revenue* ($ millions)	Total revenue ($ millions)	Operating income ($ millions)	Operating income/ revenue	Net income ($ millions)	Net income/ revenue	Revenue per employee	Net income per employee	Fiscal year ended
1	**Matsushita**	$30,400	$41,699	$3,161	7.6%	$1,617	3.9%	$216,000	$8,400	3/89
	Change from 1987	+7%	+9%	+16%		+30%				
2	**NEC**	23,355	23,355	1,400	6.0%	480	2.1%	224,500	4,700	3/89
	Change from 1987	+8%	+14%	+64%		+154%				
3	**Toshiba**	20,300	28,794	1,879	6.5%	905	3.1%	230,400	7,200	3/89
	Change from 1987	+19%	+6%	+125%		+97%				
4	**Hitachi**	19,400	48,496	3,282	6.8%	1,406	2.9%	176,300	5,100	3/89
	Change from 1987	+17%	+12%	+36%		+36%				
5	**Fujitsu**[1]	18,087	18,087	1,254	6.9%	530	2.9%	180,900	5,300	3/89
	Change from 1987	+10%	+17%	+57%		+66%				
6	**Sony**	13,700	16,252	1,216	7.5%	549	3.4%	206,000	7,000	3/89
	Change from 1987	+17%	+38%	+165%		+95%				
7	**Mitsubishi Electric**	12,500	20,582	1,189	5.8%	403	2.0%	160,000	6,100	3/89
	Change from 1987	+10%	+15%	+97%		+140%				
8	**NTT**[1]	9,700	44,257	5,555	12.6%	1,689	3.8%	240,200	4,700	3/89
	Change from 1987	—	+3%	-11%		-8%				
9	**Canon**	8,200	8,380	666	7.9%	281	3.4%	205,700	6,900	12/88
	Change from 1987	+12%	+13%	+90%		+180%				
10	**Sharp**[1]	7,700	9,453	360[2]	3.8%[2]	222	2.3%	163,000	3,800	3/89
	Change from 1987	-5%	+2%	+130%		+44%				
11	**Sanyo**	5,500	9,514	113	1.2%	46	0.5%	126,900	600	11/88
	Change from 1987	-4%	+6%	+111%		—				
12	**Ricoh**[2]	4,700	5,500	310	5.6%	130	2.4%	141,800	3,400	3/89
	Change from 1987	+7%	+8%	+1%		+3%				
13	**Oki**[1]	4,208	4,208	273	6.5%	116	2.8%	210,400	5,800	3/89
	Change from 1987	+8%	+23%	+80%		+338%				
14	**TDK**	3,170	3,170	408	12.9%	169	5.3%	158,500	8,500	11/88
	Change from 1987	-1%	+5%	+18%		+34%				
15	**Pioneer**	3,061	3,061	NA	NA	139	4.5%	236,500	10,800	9/88
	Change from 1987	+6%	+11%	NA		+62%				
16	**Omron**	2,822	2,822	301	10.7%	144	5.1%	188,100	9,600	3/89
	Change from 1987	+18%	+18%	+39%		+75%				
17	**Alps**[1,2]	2,700	2,800	60	2.1%	50	1.8%	186,700	3,300	3/89
	Change from 1987	-4%	+0%	-37%		-21%				
18	**Kyocera**	2,200	2,566	411	16.0%	225	8.8%	160,400	14,100	3/89
	Change from 1987	+5%	+13%	+31%		+31%				
19	**Casio**	2,052	2,052	86	4.2%	50	2.5%	256,500	6,300	3/89
	Change from 1987	+3%	+9%	+39%		+38%				
20	**Citizen**[1]	2,000	2,278	153	6.7%	64	2.8%	151,900	4,300	3/89
	Change from 1987	+0%	+12%	+68%		+62%				

Conversion rate: ¥132 = $1

* Electronics revenue change uses 1987 figures as originally reported

[1] Consolidation by Japanese accounting conventions, which differ from U.S. Securities and Exchange Commission rules

[2] Preliminary figures before release of final consolidated results

Source: ELECTRONIC BUSINESS

Spate of mergers challenges Europe's top companies

In their rush to build pan-European empires as 1992 approaches, European firms are cautioned against "unwieldy" growth — and against just getting products out the door

The annual ELECTRONIC BUSINESS ranking of the top electronics companies in Europe, compiled by senior editor Linda Stallmann, follows this story.

BY BARBARA N. BERKMAN

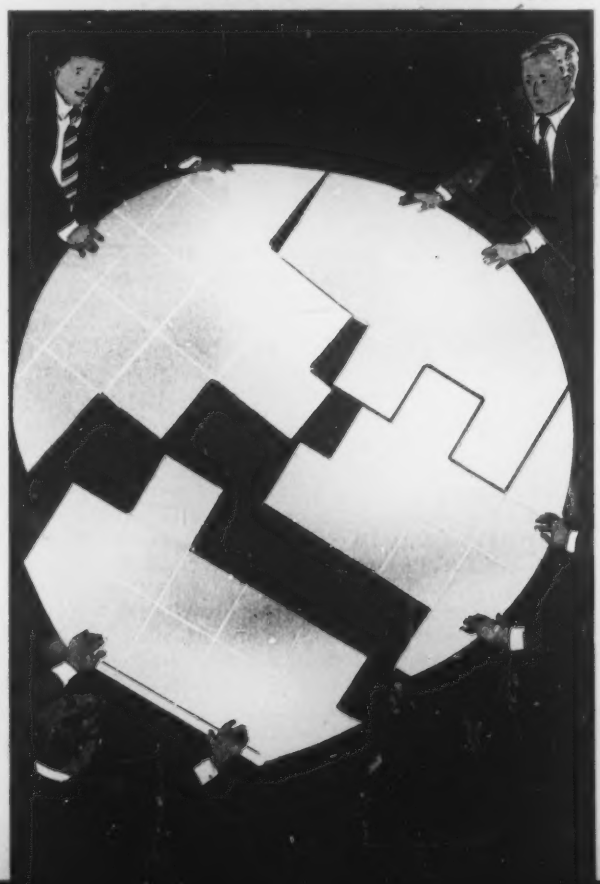
Among the brotherhood of top-ranked European electronics companies, a rite of passage has been the merger.

The latter part of this decade has been punctuated by one merger after another, as European electronics companies scramble to build pan-European empires. Driven by the need to achieve economies of scale to fund the high cost of research and development and of capital investment, all were motivated to leave behind small home markets.

The result has been a wave of marriages among European companies. In Britain alone, computer industry acquisitions increased 49% in the first half of 1989 over the same period last year, according to Regent Associates, a London consulting firm specializing in mergers and acquisitions. Britain's Racal Electronics plc leads the pack, acquiring four other companies during that period. It was also a year of hostile takeovers: A joint bid by West Germany's Siemens AG and Britain's General Electric Co. (GEC) plc swallowed Britain's Plessey Co. plc.

Those Europeans with global aspirations also stepped up investment in U.S. electronics companies. In 1988 European companies invested $33 billion to acquire U.S. companies of all types, according to market researcher Arthur D. Little Inc., based in Cambridge, Mass. In electronics, recent examples show that the trend continues.

France's Groupe Bull is expected to pay up to $635 million for the microcomputer business of Zenith Electronics Corp., which should double Bull's U.S. sales to $2 billion. British Telecommunications plc agreed to buy Tymnet, a public data network, from McDonnell Douglas Corp. in July. In August, Siemens took possession of Rolm Co., whose manufacturing and research and development operations in Santa Clara, Calif., became a wholly owned subsidiary and whose marketing and service activities in Norwalk, Conn., became owned jointly with IBM.



The spate of mergers creates a strategic challenge for Europeans. "The way in which these organizations are growing is getting too unwieldy," charges Ivor Cohen, a director of Britain's AB Electronic Products Group plc, which makes a wide range of electronic products. He predicts managers in these conglomerates will spend more of their time focusing on getting products out the door, keeping a close eye on functions such as research or distribution. But contract manufacturing and assembly will increase, following the lead of Japanese companies and even IBM, which surround themselves with a web of subcontractors.

European companies also went through a period of reorganization last year, particularly in Europe's defense electronics sector. Fueling the wave of defense restructuring was the drive to concentrate on profitable core businesses. For these companies, the increasing cost of development and production of defense equipment, coupled with the pressure on European defense budgets, proved too expensive.

In defense, a realization is sweeping through some of the companies and countries of what they can and cannot do on their own. "It is no longer feasi-

ble to develop very sophisticated defense systems exclusively for their home markets," notes Piers Whitehead, an analyst with the London brokerage firm Robert Fleming Securities Ltd.

The Dutch N.V. Philips GL is shedding its defense assets to focus on telecommunications and nonmilitary electronics, selling most of its European defense operations to France's Thomson-CSF SA Aerospace Group, the defense arm of Thomson SA. The deal represents a strategic move toward Thomson-CSF's core business, strengthening its position as Europe's leading defense conglomerate. Plessey's naval and avionics businesses were taken over by British GEC-Marconi Instruments Ltd., while its other defense operations are expected to give Siemens increased market share in military communications, command and control systems and radar.

The companies' restructuring has won accolades from the European financial community. Once considered to have lost sight of their more profitable operations, companies such as Philips, GEC, Siemens, Sweden's LM Ericsson, Finland's Nokia Oy and France's Compagnie Generale d'Electricite (CGE) are performing steadily. London's stock exchange is particularly bullish on companies in the telecommunications equipment market, expected to grow at 20% annually, estimates London brokerage firm James Capel & Co. Total European telecom demand should rise by 37% in 1990, with Ericsson and CGE riding the crest.

Restructuring European companies placed a number of nonmilitary, noncore businesses on the block as well. Both U.S. and Japanese companies have seized them as a means of easy access to the European market. "The turbulence and change that's going on is giving U.S. companies an opportunity to determine entrance mechanisms to the market," observes Barry Bright, management executive consultant in the strategy practice of Ernst & Young in London.

Movement to 1992

Indeed, Japanese, Pacific Rim and U.S. companies seeking a toehold in Europe in preparation for the single market in 1992 are stepping up activities. As in the past, companies are investing directly in European manufacturing facilities, such as Intel Corp.'s recently announced plan to build a wafer fab plant near Dublin.

There are also the traditional joint ventures: Ericsson will own 60% of a joint venture in cellular telephone handsets and private mobile radios with the U.S. General Electric Co. But it will become more common for non-Europeans to choose acquisitions as the common access route to the single market, as Europeans shed assets or look for strong partners to weather the tougher competition expected in 1992.

Already, the pace of such acquisitions is increasing. In September, AT&T announced its acquisition of Istel Ltd., a British data-networking company. Kyocera Corp., a Japanese ceramics and electronics group, bought AVX Corp., the leading maker of multilayer ceramic capacitors used in integrated circuits. The deal gave Kyocera an important European base, as AVX has plants in Ireland, Britain, West Germany and France. Japanese companies are readying to increase European production of consumer electronics, and their suppliers are expected to follow.

European-bred companies still show their traditional weakness in data processing

The Western European market for consumer electronics in 1989 was $18 billion, Capel estimates. Leading the consumer electronics industry is Philips, with 28% of the European market, followed by Thomson with 15%, Sony Corp. and Matsushita Electric Industrial Co. Ltd. with 12% each and Nokia with 9%.

Philips' consumer products sector has improved in profitability since restructuring began in 1987. In 1988, 12.3% of revenue from Philips' core businesses came from consumer products, and 32% of profitability, with a significant increase in sales of color televisions and compact disc (CD) players in the United States. Philips won the largest single order of televisions — more than $150 million worth — when it agreed to supply 300,000 color TVs, 16,000 video cassette recorders and 8,000 satellite dishes to Whittle Communications LP, a print media and television corporation in Knoxville, Tenn.

Philips is enjoying its share in the growing European demand for consumer electronics. It is a market driven by new technologies such as CD interactive and CD video, high-definition television and satellite systems. The European Economic Community is taking a dominant role in cultivating that technology. For the past three years it funded 35% of a $500 million European research effort in HDTV; trials should start in 1990. To protect European CD makers, the EEC in July imposed antidumping duties of up to 33.9% on Japanese CD players.

Still weak in data processing

European-bred companies, however, still show their traditional weakness in data processing. Although West Germany's Nixdorf Computer AG and Italy's Ing. C. Olivetti & Co. SpA have been among Europe's stronger computer makers, both have gone through recent retrenching. Unlike their U.S. counterparts, European manufacturers generally have been slow to move to smaller, networked solutions. "With computers, the big issue in Europe is, who is going to end up with whom?" Ernst & Young's Bright asks.

The European market will not support Bull, Nixdorf and Olivetti, he predicts, and major collaborative deals or perhaps an acquisition will result. Until then, European computer makers are showing signs of recovery that should strengthen their ability to compete with their counterparts in the United States. Olivetti's earnings, for example, are projected to grow by 39% in 1990. Troubled Nixdorf's cost-cutting measures won't demonstrate results until 1990, but progress is good. Nixdorf had kept costs in mid-1989 to the same level as the past year. Now the German computer company expects to report an operating profit in the year's second half.

Daring strategies might be necessary to compete in the 1990s in the market shaping up for data processing in Europe. Demand for information systems is expected to increase sharply when the financial community deregulates in 1992. □

Top electronics companies in Europe — 1988

Rank	Company	Electronics sales ($ millions)	Electronics sales as a percentage of total sales	Total consolidated sales ($ millions)	Profit before tax as a percentage of sales	Profit after tax as a percentage of sales	Sales per employee	Profit before tax per employee
1	**Philips**	$20,803	73%	$28,382	1.4%	0.9%	$91,468	$1,321
2	**IBM**	20,520	34%	59,681	15.1%	9.2%	154,170	23,334
3	**Siemens**	17,389	51%	34,140	4.2%	2.3%	96,713	4,032
4	**CGE**	12,226	57%	21,482	4.3%	1.1%	105,250	4,532
5	**Thomson**	11,149	89%	12,563	5.1%	1.6%	121,148	6,205
6	**GEC**	6,795	65%	10,404	13.6%	8.7%	71,734	9,723
7	**Olivetti**	6,375	99%	6,459	5.1%	4.2%	112,212	5,774
8	**Robert Bosch**	6,265	40%	15,762	8.0%	2.0%	95,104	7,570
9	**Groupe Bull**	5,296	100%	5,296	2.0%	0.7%	116,252	2,324
10	**Digital Equipment**	5,130	40%	12,742	11.1%	8.4%	101,287	11,293
11	**Matsushita**	4,566	11%	42,907	9.6%	3.9%	222,213	21,374
12	**Ericsson**	4,290	84%	5,101	6.8%	4.2%	78,317	5,305
13	**STC**	3,936	94%	4,196	9.8%	6.1%	123,968	12,098
14	**Xerox**	3,908	24%	16,441	6.1%	2.4%	145,181	8,875
15	**Sony**	3,493	21%	16,723	7.7%	3.4%	235,539	18,172
16	**Hewlett-Packard**	3,304	34%	9,831	11.6%	8.3%	113,000	13,126
17	**AEG**	3,303	43%	7,620	1.0%	0.2%	85,062	833
18	**Nokia**	3,208	62%	5,207	5.0%	3.7%	116,789	5,818
19	**Nixdorf**	3,045	100%	3,045	NA	NA	98,114	NA
20	**British Telecom**	2,965	15%	19,595	22.0%	14.3%	80,729	17,770
21	**Unisys**	2,888	29%	9,902	9.7%	6.9%	106,473	10,308
22	**Canon**	2,649	31%	8,631	7.8%	3.4%	211,856	16,440
23	**Asea Brown Boveri**	2,600	15%	17,832	3.0%	2.2%	105,229	3,163
24	**Memorex Telex**	2,242	100%	2,242	2.5%	1.7%	203,802	5,152
25	**NCR**	1,975	33%	5,990	13.1%	7.3%	99,832	13,119
26	**Grundig**	1,903	100%	1,903	4.8%	4.1%	97,975	4,719
27	**Bayer**	1,822	8%	23,048	9.3%	4.7%	139,252	12,993
28	**Racal**	1,770	63%	2,813	11.2%	7.9%	83,469	9,345
29	**Toshiba**	1,693	6%	29,628	6.2%	3.1%	237,028	14,644
30	**Hitachi**	1,523	3%	49,900	7.7%	2.9%	181,781	13,946
31	**Ferranti**	1,522	82%	1,865	5.3%	3.6%	81,710	4,327
32	**Schlumberger**	1,500	30%	4,925	12.0%	9.2%	102,594	12,261
33	**Motorola**	1,500	18%	8,250	7.4%	5.4%	80,882	6,000
34	**Matra**	1,483	46%	3,245	5.3%	1.8%	166,595	8,851
35	**Mannesmann**	1,244	11%	11,631	4.4%	2.1%	95,506	4,166

NA = Not available

Electronics sales: Represents ELECTRONIC BUSINESS' estimate of the revenue earned by each company from the sale of electronics products.

The figure shown is based on the latest available completed fiscal year, thus a variety of accounting periods are represented.

Similarly, the electronics sales and other financial information has been converted to dollars using an exchange rate that consists of the average rate during each company's fiscal year.

For European companies, the figure shown is their worldwide sales of electronics products, including those manufactured and sold outside Europe: for non-European companies the figure estimates their electronics sales in Western Europe only.

Electronics as a percentage of total sales: Indicates the proportion of electronics products within the total consolidated sales of all the products of the company. For firms not European owned, the percentage relates to their electronics sales in Western Europe as a percentage of total consolidated worldwide sales.

Profit after tax per employee	Fixed assets per employee	Investments as a percentage of sales	Return on gross capital employed	R&D as a percentage of sales	Capital expenditures as a percentage of sales	Current ratio	Fiscal year ended	Country of origin
$866	$30,269	14.3%	2.4%	8.2%	6.1%	1.54	12/88	Netherlands
14,185	60,515	19.0%	17.1%	9.9%	9.0%	2.03	12/88	United States
2,266	22,151	17.8%	9.6%	10.9%	6.9%	1.87	9/88	West Germany
1,195	17,027	12.8%	12.4%	8.4%	4.5%	1.09	12/88	France
1,938	16,854	9.9%	18.1%	5.6%	4.3%	1.15	12/88	France
6,226	11,317	9.9%	22.1%	5.0%	4.9%	2.07	3/89	Britain
4,754	20,805	12.6%	6.1%	5.4%	7.3%	2.20	12/88	Italy
1,904	15,710	12.9%	18.4%	5.9%	7.0%	2.34	12/88	West Germany
828	32,260	19.2%	4.2%	10.1%	9.1%	1.50	12/88	France
8,526	28,982	21.6%	17.4%	12.0%	9.6%	2.88	6/89	United States
8,618	33,274	11.7%	14.2%	5.8%	5.9%	1.65	3/89	Japan
3,286	16,713	16.8%	10.9%	11.3%	5.6%	1.90	12/88	Sweden
7,622	20,567	14.7%	26.8%	9.0%	5.7%	1.60	12/88	Britain
3,426	17,731	7.9%	10.1%	4.8%	3.1%	NA	12/88	United States
7,956	59,812	16.7%	17.1%	6.6%	10.1%	1.28	3/89	Japan
9,379	28,920	17.0%	26.2%	10.4%	6.6%	1.72	10/88	United States
172	14,838	14.3%	2.3%	8.1%	6.2%	2.08	12/88	West Germany
4,362	28,979	10.8%	10.0%	4.8%	6.0%	1.50	12/88	Finland
NA	31,306	23.9%	-3.7%	9.9%	14.0%	0.89	12/88	West Germany
11,514	98,105	28.6%	19.0%	1.9%	26.6%	0.86	3/89	Britain
7,318	24,467	14.0%	19.8%	7.2%	6.8%	1.69	12/88	United States
7,106	49,066	13.4%	13.2%	5.9%	7.5%	1.60	12/88	Japan
2,278	20,264	11.4%	6.0%	7.3%	4.1%	1.56	12/88	Switzerland
3,509	20,360	3.5%	9.8%	1.9%	1.6%	1.38	3/89	Netherlands
7,321	18,579	14.0%	33.6%	7.0%	7.0%	1.69	12/88	United States
3,990	19,065	10.5%	12.1%	4.0%	6.5%	1.75	3/89	West Germany
6,569	38,436	13.9%	18.7%	6.1%	7.8%	1.65	12/88	West Germany
6,616	26,867	11.7%	18.4%	NA	11.5%	1.61	3/89	Britain
7,446	49,253	12.1%	15.9%	6.1%	6.1%	1.12	3/89	Japan
5,270	41,844	14.2%	14.1%	5.8%	8.3%	1.53	3/89	Japan
2,955	19,673	11.9%	9.9%	5.5%	6.3%	1.51	3/89	Britain
9,456	33,681	16.4%	21.2%	7.2%	9.2%	1.28	12/88	Netherlands
4,363	27,980	19.0%	17.3%	8.1%	10.9%	1.26	12/88	United States
2,922	NA	7.0%	NA	0.0%	7.0%	NA	12/88	France
2,034	18,230	6.4%	12.3%	2.2%	4.2%	1.42	12/88	West Germany

Fixed assets per employee: Shows the accumulated value (less depreciation) of land, buildings, plant, machinery, furniture and fittings (including rental equipment) that the company has invested per employee.

Investments as a percentage of sales: Adds together capital expenditures and research and development as a proportion of total consolidated sales.

Return on gross capital employed: Shows profit before taxes as a proportion of net working capital plus fixed assets and investment (for example, equity holdings and other assets, not capital expenditures).

Capital expenditures as a percentage of sales: Shows the amount of new investment in fixed assets during the year as a proportion of total consolidated sales.

Current ratio: Shows current assets as a proportion of current liabilities, giving a rough indication of the liquidity of the company.

Country or origin: Indicates the country in which the company is ultimately registered.

Source: ELECTRONIC BUSINESS

The fastest growing U.S. electronics companies

Sheer sales volume is impressive by any count, and if that revenue intake is accompanied by consistently large profits, then the company is deemed a success.

But the unique history of America's electronics sector has produced a third register of success: rate of sales growth. Just look at the awe that Compaq Computer Corp.'s track record commands: can a company that hurtles from nothing to more than $2 billion in sales in seven years be considered anything but a hit?

By hitting $111 million in sales for its first full year of business, Compaq became not only the fastest-growing company in the history of electronics, but in the history of American business. And it helped establish revenue growth as a valid performance gauge. It also helped create awareness that the management of that growth makes many other executive challenges look like child's play.

ELECTRONIC BUSINESS recognized the value of a fast-growth measure four years ago, and launched what has become one of its most eagerly read features: its tables of the top 100 fastest-growing U.S. companies.

The conditions are simple: the companies must be publicly held and U.S.-based, and must show six years of sales results because the figure we use is compounded annually for five years of growth. And in their first year of business, they must have reached at least $750,000 in sales (clearly, the smaller the first-year sales, the higher the growth rate. One dollar in first-year sales would produce a ridiculously high figure).

Top 10 fastest growing companies

1988 rank	Company	Five-year sales growth	Fiscal 1988 sales ($ millions)
1	Sun Microsystems	161.2%	$1,051.6
2	Oracle Systems	123.7%	282.1
3	3Com	121.3%	251.9
4	Novell	118.3%	281.2
5	AST Research	100.6%	412.7
6	Symbol Technology	88.0%	89.0
7	Micron Technology	87.0%	300.5
8	Mark IV Industries	79.6%	403.0
9	Compaq Computer	79.4%	2,065.6
10	Ashton-Tate	76.2%	307.3

By those criteria, revenue racers such as disk-drive maker Conner Peripherals Inc. (which last year beat Compaq's first-year growth record) and PC powerhouse Dell Computer Corp. don't make our formal list.

This year, as usual, we break down the data by segment to show which industry areas were hot and which less so. But we're taking the analysis a step further, unearthing facets that we feel are of considerable interest. We examine IBM's position in the tables; look at which states hosted the most fast movers; analyze why some companies climbed the rankings while others slid, and much more.

A few snapshots: most of the top 10 are computer or computer-related companies. Three of the 10 — Sun Microsystems Inc., Oracle Corp. and AST Research Inc. — are back, showing that they understand the rudiments of growth management. And two of the newcomers to the list — 3Com Corp. and Novell Corp. — show up as the fastest of the fastest, racing along in PC conectivity □

Facts behind the figures

The following pages comprise ELECTRONIC BUSINESS' special report on fast-growing U.S. electronics companies. The 100 companies listed are all publicly held and are ranked in order of their compounded annual growth rates, calculated over a five-year time span on six years of reported revenue results.

Additional analysis examines the growth rates of particular industry segments, with comparisons with the previous year. ELECTRONIC BUSINESS breaks out the U.S. states with the largest number of fast-growth firms; highlights the corporations with sales in the billions of dollars which still manage to achieve impressive sales gains; examines which companies climbed the fastest growth charts, and why; and looks at where IBM has placed over the past few years.

Top 10 fastest growing companies

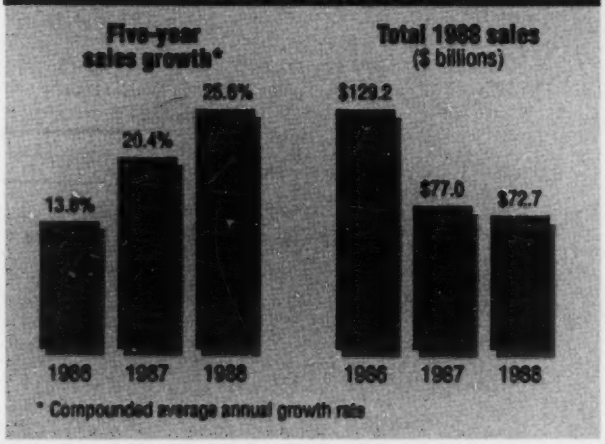
1988 rank	Company	Market	Five-year sales growth	Fiscal 1988 sales ($ millions)
1	Sun Microsystems	Workstations	161.2%	$1,051.6
2	Oracle Systems	Database software	123.7%	282.1
3	3Com	LAN equipment	121.3%	251.9
4	Novell	LAN software	118.3%	281.2
5	AST Research	Boards and PCs	100.6%	412.7
6	Symbol Technology	Bar code scanners	88.0%	89.0
7	Micron Technology	Semiconductors	87.0%	300.5
8	Mark IV Industries	Diversified	79.6%	403.0
9	Compaq Computer	Microcomputers	79.4%	2,065.6
10	Ashton-Tate	Database software	76.2%	307.3

Faster growth, smaller companies

In 1988, the top 100 fastest growing U.S. electronics companies had a five-year compounded annual growth rate of 25.6%. That marked an increase over 1987's 20.4% climb — and a result that might appear puzzling given that the industry is maturing. But even though the growth rate accelerated, the total revenue declined from $77.0 billion to $72.7 billion in the same period.

One conclusion? The industry is regenerating healthily, as more small companies made the list.

The overall picture



New entries to the fastest growing list

Company	Five-year sales growth	Fiscal 1988 sales ($ millions)	1988 rank
3Com	121.3%	$251.9	3
Novell	118.3%	281.2	4
Symbol Technologies	88.0%	89.0	6
Compaq Computer	79.4%	2,065.6	9
Computer Associates	64.9%	709.1	17
Rexon	63.6%	155.5	19
Hutchinson Technology	47.8%	113.7	30
Valid Logic Systems	46.5%	108.4	32
Xicor	41.8%	90.1	36
KLA Instruments	37.0%	112.9	39

New guys in town

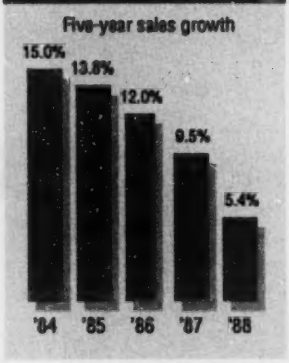
New to the list are 26 firms, with at least one surprise among them. 3Com and Novell head the top 10 newcomers, and their position owes more to the market they drive — small computer connectivity — than to their own youth. Software behemoth Computer Associates is getting big by buying company after company. And KLA Instruments is, on the face of it, the surprise: a fast-growing IC production equipment maker?

KLA is most active in optical inspection techniques. Its ranking is an indication that quality is uppermost in the minds of managers these days.

Where's IBM?

Big Blue once made the fastest growing list; in the heydey of the PC, it showed up with 15% average annual growth. Not anymore. IBM last year produced a 5.4% sales gain — evidence that it has lost steam in PC markets and that mainframe and minicomputer sales have yet to regain momentum.

IBM's slide



Billion dollar companies keep on ticking

Company	Fiscal 1988 sales ($ millions)	Five-year sales growth	1988 rank
DEC	$11,475.4	21.9%	69
Unisys	9,902.0	18.2%	82
Hewlett-Packard	9,831.0	15.9%	100
Apple Computer	4,071.4	32.9%	44
Intel	2,874.8	20.7%	74
Compaq Computer	2,065.6	79.4%	9
Amdahl	1,801.8	18.3%	81
Prime Computer	1,594.6	25.3%	61
Loral	1,440.8	36.0%	40
Tandem Computers	1,314.7	25.7%	59
Seagate Technology	1,266.0	62.9%	21
Advanced Micro Devices	1,125.9	25.7%	60
Sun Microsystems	1,051.6	161.2%	1

The billionaires are still bountiful

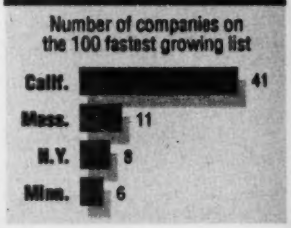
You'd think that giant corporations with sales in the billions of dollars would be pushed to grow much at all. But 13 of the billion-dollar-plus club made the lists. Several others didn't cut it, among them: Amp (12%); E-Systems (13%); Motorola (13%); Tandy (11%); Wang (15%); and Zenith (15%). The figures are for five-year compounded growth.

California gold rush; Mass. misery

The Golden State holds its previous year's lead as the state with the most revenue racers. Last year, 41 of the fastest called California home — the same as in 1987. New England reflects the erosion of the "Massachusetts Miracle;" the Route 128 score is 11, down from 14 a year earlier.

Of the 26 newcomers to the lists, California claims seven, but New York (5), Minnesota (3) and Texas (2) are inching up.

Hot growth spots



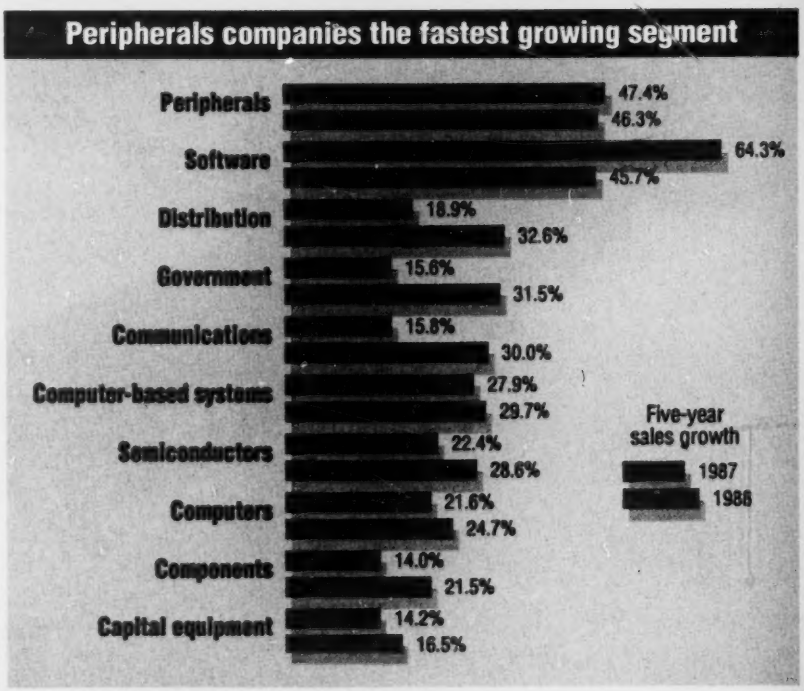
Peripherals makers head hot-growth pack

Makers of computer peripherals products scored the highest collective average growth rate — 46.3%, followed by the previous year's top-ranked sector, software firms, with 45.7% compounded annually.

Software sector growth has backed off some: in 1987, it showed 64.3%, which means that the business is maturing and consolidating. But, software shows more companies: nine in this year's lists, compared with six in 1987. Oracle Corp., developer and marketer of relational database management systems, led the pack of software companies with a five-year compouded average annual growth rate of 123.7%, making it one of the fastest growing software companies.

Comparing the weighted averages for 1987's versus 1988's five-year compounded average annual growth, all segments showed an improvement except for software.

Peripherals companies the fastest growing segment



1988's fastest growing U.S. companies

1988 rank	Company	Five-year sales growth*	Fiscal 1988 sales ($ millions)	Fiscal 1988 profits ($ millions)	Fiscal year ended	Location
1	Sun Microsystems	161.2%	$1,051.6	$66.4	6/88	Mountain View, Calif.
2	Oracle Systems	123.7%	282.1	42.9	5/88	Belmont, Calif.
3	3Com	121.3%	251.9	22.5	5/88	Santa Clara, Calif.
4	Novell	118.3%	281.2	30.4	10/88	Provo, Utah
5	AST Research	100.6%	412.7	15.1	6/88	Irvine, Calif.
6	Symbol Technologies	88.0%	89.0	20.2	6/88	Bohemia, N.Y.
7	Micron Technology	87.0%	300.5	98.0	8/88	Boise, Idaho
8	Mark IV Industries	79.6%	403.0	17.0	2/88	West Amherst, N.Y.
9	Compaq Computer	79.4%	2,065.6	255.2	12/88	Houston, Texas
10	Ashton-Tate	76.2%	307.3	47.8	1/88	Torrance, Calif.
11	Iomega	73.6%	111.5	8.6	12/88	Roy, Utah
12	Wyse Technology	73.3%	456.6	28.0	3/88	San Jose, Calif.
13	Western Digital	72.6%	768.3	43.0	6/88	Irvine, Calif.
14	Stratus Computer	66.8%	265.3	29.3	12/88	Marlboro, Mass.
15	QMS	66.5%	186.7	-5.0	9/88	Mobile, Ala.
16	Intelligent Systems	65.1%	152.6	-9.0	12/88	Norcross, Ga.
17	Computer Associates	64.9%	709.1	101.8	3/88	Garden City, N.Y.
18	Microsoft	63.8%	590.8	123.9	6/88	Redmond, Wash.
19	Rexon	63.6%	155.5	9.0	9/88	Culver City, Calif.
20	Mentor Graphics	63.4%	300.8	33.5	12/88	Beaverton, Ore.
21	Seagate Technology	62.9%	1,266.0	77.3	6/88	Scotts Valley, Calif.
22	LSI Logic	61.2%	378.9	23.8	12/88	Milpitas, Calif.
23	Digital Communications Assoc.	59.9%	227.5	42.2	6/88	Alpharetta, Ga.
24	Lotus Development	54.6%	468.5	58.9	12/88	Cambridge, Mass.
25	Apollo Computer	52.0%	653.5	0.2	12/88	Chelmsford, Mass.
26	Archive	51.7%	122.7	10.5	9/88	Costa Mesa, Calif.
27	MiniScribe	51.1%	603.3	25.9	12/88	Longmont, Colo.
28	Symbolics	50.8%	81.3	-46.0	6/88	Cambridge, Mass.
29	Emerson Radio	50.3%	728.8	-12.0	3/88	North Bergen, N.J.
30	Hutchinson Technology	47.8%	113.7	4.3	9/88	Hutchinson, Minn.
31	Micropolis	46.9%	353.1	-19.4	12/88	Chatsworth, Calif.
32	Valid Logic Systems	46.5%	108.4	6.1	12/88	San Jose, Calif.
33	Daisy Systems	46.4%	117.4	6.9	9/88	Mountain View, Calif.
34	VLSI Technology	43.9%	221.2	6.7	12/88	San Jose, Calif.
35	Anthem Electronics	43.7%	264.6	11.3	12/88	San Jose, Calif.
36	Xicor	41.8%	90.1	14.0	12/88	Milpitas, Calif.
37	Silicon Systems	39.8%	120.8	12.7	9/88	Tustin, Calif.
38	Ultimate	39.8%	209.2	13.0	4/88	East Hanover, N.J.
39	KLA Instruments	37.0%	112.9	8.8	6/88	Santa Clara, Calif.
40	Loral	36.0%	1,440.8	74.3	3/88	New York, N.Y.
41	Quantum	35.2%	188.5	-3.2	3/88	Milpitas, Calif.
42	Cray Research	34.8%	756.3	156.6	12/88	Minneapolis, Minn.
43	SCI Systems	33.5%	774.2	19.0	6/88	Huntsville, Ala.
44	Apple Computer	32.9%	4,071.4	400.3	9/88	Cupertino, Calif.
45	Intermec	31.9%	85.2	5.2	3/88	Lynnwood, Wash.
46	Teixon	30.6%	123.9	14.0	3/88	Akron, Ohio
47	BancTec	30.5%	93.4	6.4	3/88	Dallas, Texas
48	Emulex	29.5%	125.1	9.1	6/88	Costa Mesa, Calif.
49	Ask Computer	29.3%	142.4	10.8	6/88	Los Altos, Calif.
50	Instrument Systems	29.1%	381.1	6.1	10/88	Jericho, N.Y.

* Compounded average annual growth rate

(Continued)

1988's fastest growing U.S. companies

1988 rank	Company	Five-year sales growth*	Fiscal 1988 sales ($ millions)	Fiscal 1988 profits ($ millions)	Fiscal year ended	Location
51	Bolt Beranek and Newman	29.0%	$305.2	$18.1	6/88	Cambridge, Mass.
52	LTX	28.3%	174.8	7.0	7/88	Westwood, Mass.
53	Richardson Electronics	28.2%	118.3	11.2	5/88	La Fox, Ill.
54	Applied Materials	28.0%	362.8	40.0	10/88	Santa Clara, Calif.
55	Microsemi	27.9%	83.7	2.5	9/88	Santa Ana, Calif.
56	Marshall Industries	26.4%	420.4	17.6	5/88	El Monte, Calif.
57	Intergraph	26.0%	800.2	88.0	12/88	Huntsville, Ala.
58	Data Switch	25.8%	113.8	3.3	12/88	Shelton, Conn.
59	Tandem Computers	25.7%	1,314.7	94.5	9/88	Cupertino, Calif.
60	Advanced Micro Devices	25.7%	1,125.9	19.3	12/88	Sunnyvale, Calif.
61	Prime Computer	25.3%	1,594.6	19.0	12/88	Natick, Mass.
62	Applied Magnetics	23.6%	293.0	23.7	9/88	Goleta, Calif.
63	Molex	23.3%	502.4	59.3	6/88	Lisle, Ill.
64	Diceon Electronics	23.1%	140.7	9.9	9/88	Irvine, Calif.
65	Network Systems	22.8%	131.5	11.4	12/88	Minneapolis, Minn.
66	Systematics	22.8%	179.5	15.4	8/88	Little Rock, Ark.
67	Dynatech	22.3%	367.8	24.5	3/88	Burlington, Mass.
68	American Management Systems	21.9%	213.3	7.4	12/88	Arlington, Va.
69	DEC	21.9%	11,475.4	1,305.6	6/88	Maynard, Mass.
70	Burr-Brown	21.8%	176.7	11.5	12/88	Tucson, Ariz.
71	Vishay Intertechnology	20.9%	109.0	15.5	6/88	Malvern, Pa.
72	Micom Systems	20.8%	223.4	9.8	3/88	Simi Valley, Calif.
73	Cullinet Software	20.7%	216.7	-47.0	4/88	Westwood, Mass.
74	Intel	20.7%	2,874.8	452.9	12/88	Santa Clara, Calif.
75	AVX	20.5%	408.9	27.6	12/88	Great Neck, N.Y.
76	Norstan	20.1%	85.9	2.4	4/88	Plymouth, Minn.
77	Dynamics Research	19.1%	92.9	4.1	12/88	Wilmington, Mass.
78	Finnigan	18.8%	130.7	8.2	12/88	San Jose, Calif.
79	Altos	18.7%	175.9	22.2	6/88	San Jose, Calif.
80	ADC Telecommunications	18.7%	179.9	17.0	10/88	Bloomington, Minn.
81	Amdahl	18.3%	1,801.8	213.8	12/88	Sunnyvale, Calif.
82	Unisys	18.2%	9,902.0	680.6	12/88	Detroit, Mich.
83	General DataComm	18.1%	196.2	-18.4	9/88	Middlebury, Conn.
84	Sheldahl	17.8%	83.9	0.5	7/88	Northfield, Minn.
85	Cipher Data Products	17.7%	185.4	10.4	6/88	San Diego, Calif.
86	Gerber Scientific	17.7%	264.0	29.6	4/88	South Windsor, Conn.
87	Park Electrochemical	17.6%	128.1	7.0	2/88	Lake Success, N.Y.
88	Diasonics	17.6%	281.6	9.8	12/88	South San Francisco, Calif.
89	Priam	17.5%	142.0	0.5	6/88	San Jose, Calif.
90	Recognition Equipment	17.4%	260.8	-12.2	10/88	Dallas, Texas
91	AEL Industries	17.3%	119.6	2.1	2/88	Landsdale, Pa.
92	Cherry	17.3%	194.6	7.4	2/88	Waukegan, Ill.
93	Zeus Components	17.3%	98.5	0.9	9/88	Port Chester, N.Y.
94	Measurex	16.7%	265.2	37.1	11/88	Cupertino, Calif.
95	Pioneer-Standard	16.5%	254.6	5.2	3/88	Cleveland, Ohio
96	ISC Systems	16.5%	170.8	8.2	6/88	Spokane, Wash.
97	Evans & Sutherland	16.4%	129.6	1.9	12/88	Salt Lake City, Utah
98	Management Science America	16.3%	250.0	-33.6	12/88	Atlanta, Ga.
99	Logicon	16.2%	218.9	9.1	3/88	Torrance, Calif.
100	Hewlett-Packard	15.9%	9,831.0	816.0	10/88	Palo Alto, Calif.

* Compounded average annual growth rate

Source: ELECTRONIC BUSINESS

1988's fastest growing U.S. companies by industry segment

Capital equipment

	Five-year growth* Sales	Profits	1988 rank
KLA Instruments	37.0%	24.7%	39
LTX	28.3%	22.8%	52
Applied Materials	28.0%	67.3%	54
Vishay	20.9%	28.5%	71
Gerber Scientific	17.7%	45.8%	86
Hewlett-Packard	15.9%	13.6%	100
Weighted average	**16.5%**	**15.3%**	

Communications

3Com	121.3%	331.9%	3
Novell	118.3%	NM	4
Digital Communications Associates	59.9%	82.9%	23
Instrument Systems	29.1%	20.6%	50
Bolt Beranek and Newman	29.0%	40.7%	51
Data Switch	25.8%	-11.6%	58
Network Systems	22.8%	2.5%	65
Dynatech	22.3%	20.2%	67
Micom Systems	20.8%	-4.6%	72
Norstan	20.1%	24.8%	76
Dynamics Research	19.1%	32.0%	77
ADC Telecom.	18.7%	25.4%	80
General DataComm	18.1%	NM	83
Weighted average	**30.0%**	**25.6%**	

Components (other than semiconductors)

Microsemi	27.9%	17.4%	55
Molex	23.3%	21.9%	63
AVX	20.5%	26.0%	75
Cherry	17.3%	18.5%	92
Weighted average	**21.5%**	**22.6%**	

Computer-based systems

Symbol Technologies	88.0%	NM	6
Mark IV Industries	79.6%	78.6%	8
Mentor Graphics	63.4%	NM	20
Valid Logic Systems	46.5%	47.8%	32
Daisy Systems	46.4%	24.4%	33
Telxon	30.6%	NA	46
BancTec	30.5%	NM	47
Ask Computer	29.3%	22.6%	49
AMS	21.9%	29.7%	68
Finnigan	18.8%	NA	78

(Continued)

Computer-based systems (continued)

Recognition Equipment	17.4%	NM	90
Measurex	16.7%	50.5%	94
ISC Systems	16.5%	15.6%	96
Evans & Sutherland	16.4%	-29.5%	97
Weighted average	**29.7%**	**41.3%**	

Computers

Sun Microsystems	161.2%	152.0%	1
Compaq Computer	79.4%	150.3%	9
Stratus Computer	66.8%	68.0%	14
Rexon	63.6%	NM	19
Apollo Computer	52.0%	-55.5%	25
Symbolics	50.8%	NM	28
Cray Research	34.8%	43.1%	42
Apple Computer	32.9%	44.2%	44
Intergraph	26.0%	24.6%	57
Tandem Computers	25.7%	25.1%	59
Prime Computer	25.3%	-10.2%	61
DEC	21.9%	35.7%	69
Altos Computer	18.7%	22.9%	79
Amdahl	18.3%	37.7%	81
Unisys	18.2%	28.2%	82
Weighted average	**24.7%**	**35.3%**	

Distribution

Emerson Radio	50.3%	NM	29
Anthem Electronics	43.7%	52.7%	35
Marshall Industries	26.4%	66.7%	56
Zeus Components	17.3%	19.7%	93
Pioneer-Standard	16.5%	53.7%	95
Weighted average	**32.6%**	**27.6%**	

Government

Loral	36.0%	22.9%	40
SCI Systems	33.5%	23.6%	43
AEL Industries	17.3%	-1.0%	91
Logicon	16.2%	15.6%	99
Weighted average	**31.5%**	**21.3%**	

Peripherals

AST Research	100.6%	56.5%	5
Iomega	73.6%	NM	11

(Continued)

Peripherals (continued)

Wyse Technology	73.3%	90.1%	12
QMS	66.5%	NM	15
Intelligent Systems	65.1%	NM	16
Seagate Technology	62.9%	43.9%	21
Archive	51.7%	67.6%	26
MiniScribe	51.1%	55.8%	27
Micropolis	46.9%	NM	31
Quantum	35.2%	NM	41
Intermec	31.9%	19.4%	45
Emulex	29.5%	10.3%	48
Applied Magnetics	23.6%	28.7%	62
Sheldahl	17.8%	NM	84
Cipher Data Products	17.7%	11.8%	85
Priam	17.5%	-30.0%	89
Weighted average	**46.3%**	**29.5%**	

Semiconductors

Micron Technology	87.0%	NM	7
Western Digital	72.6%	96.3%	13
LSI Logic	61.2%	19.1%	22
VLSI Technology	43.9%	NM	34
Xicor	41.8%	NM	36
Silicon Systems	39.8%	NM	37
Richardson Electronics	28.2%	34.8%	53
Advanced Micro Devices	25.7%	-1.6%	60
Burr-Brown	21.8%	21.8%	70
Intel	20.7%	31.3%	74
Weighted average	**28.6%**	**38.5%**	

Software

Oracle Systems	123.7%	130.6%	2
Ashton-Tate	76.2%	113.7%	10
Computer Associates	64.9%	79.4%	17
Microsoft	63.8%	80.4%	18
Lotus Development	54.6%	33.8%	24
Ultimate	39.8%	23.0%	38
Systematics	22.8%	26.9%	66
Cullinet Software	20.7%	NM	73
Management Science America	16.3%	NM	98
Weighted average	**45.7%**	**41.1%**	

NA = Not available

NM = Not meaningful, company had a loss in one of the base years

* Compounded average annual growth rate

Source: ELECTRONIC BUSINESS

Coining it: Top U.S. firms show 12% profits gain

Averaging 8.7% after-tax profit in '88, the 100 most profitable U.S. electronics firms net 64% more than U.S. industry overall

BY RAY WISE

Paced by the high-flying semiconductor, systems and government groups, the elite of the U.S. electronics industry posted another hefty year-to-year gain in profitability last year.

The ELECTRONIC BUSINESS top 100, the industry's most profitable public companies, crossed the tape last December 31 with a weighted average after-tax profit margin of 8.7%, a jump of nearly 12% over the year-earlier profitability of 7.8%.

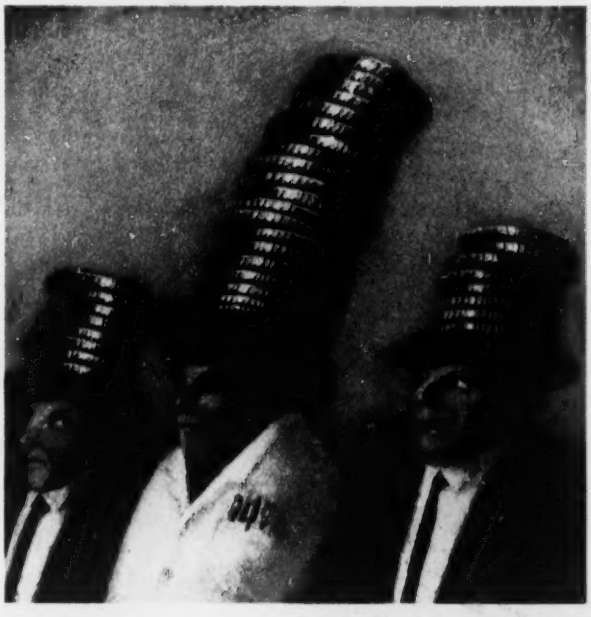
The 1988 profit margin of the top 100 represents a 64% superiority over the 5.3% profitability of the average U.S. industrial company. The least profitable enterprise in the top 100, Kulicke & Soffa Industries Inc., a maker of semiconductor capital equipment, posted an after-tax margin of 5.2%, just about matching the all-industry average.

This latest top 100 report only heightens the stark contrast between the outstanding financial performance of high tech's leading companies and their lack of recognition on Wall Street, where their stock market valuations have been at historical lows on and off since 1983.

The top two ventures of the top 100, Micron Technology Inc., a semiconductor maker, and Symbol Technologies Inc., which is in the bar-code scanner business, had not even made the cut in last year's ELECTRONIC BUSINESS rankings of the most profitable. This time around they came in with awesome profit margins of 32.6% and 22.7%, respectively.

Such is the dynamism of this growth industry that there were eight outfits in the 1988 top 20 that weren't even eligible for the top 100 in '87. Five of the top 20 companies are in semiconductors, another five are in software, and only three make computers: Cray Research Inc., Altos Computer Systems and Compaq Computer Corp.

Technically, the office equipment group scored the biggest year-to-year profitability gain, a resounding 47%, but this was a statistical fluke. Low-margin Xerox Corp. fell out of the rankings in 1988, shrinking the office equipment group to three much more profitable companies. But Diebold Inc. and NCR Corp. slipped in profitability year to year, and Pitney Bowes Inc. was flat. What at first sight looked like a homer, turned out to be a run driven in by a base on balls.



Kevin Hawkes

The batting crown really belongs to the semiconductor group, whose after-tax profit margin improved 42% from 1987 to 1988.

Cray Research Inc., which nailed down first place in last year's top 100 with a 21.4% profit margin, fell to the fourth spot as its profitability slipped to 20.7% — a nominal decline. Cray's revenue expanded a healthy 10% last year, but the company has been corralling commercial customers, which tend to lease rather than buy. Cray derives fatter profits from its traditional marketplace — government agencies and universities — which usually purchase its supercomputers.

Setbacks

The biggest year-to-year profitability setback among the companies entered in both last year's and this year's top 100 fell to Tandem Computers Inc., which had a drop of 29%. But that's not as onerous as it sounds; Tandem, with an eye to its future, spends heavily, developing new markets and new technology, with the result that it does not always convert sales growth into higher earnings.

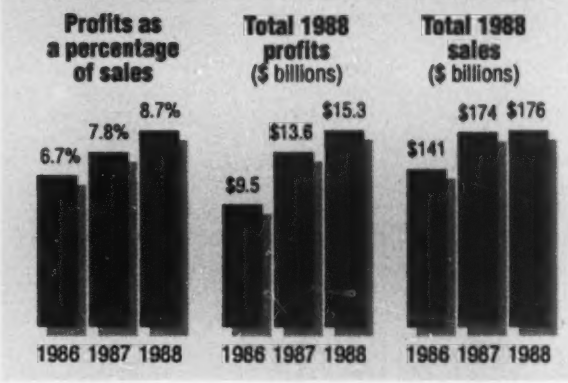
In the bombed-out computer peripherals group (income down nearly 25% in '88), a 58% plunge in the profitability of disk-drive giant Seagate Technology masked outstanding gains by other peripherals makers. Tape drive firm Archive chalked up a net margin gain of 25%, and fellow peripherals firms Applied Magnetics and Emulex saw net margin gains of 21% and more than 100%, respectively. □

Facts behind the figures

On the pages that follow, ELECTRONIC BUSINESS provides a listing of the 100 most profitable U.S. electronics firms. They are all publicly held with sales of $80 million or more, and are ranked in order of their ratio of net income to revenue for fiscal 1988.

U.S. firms have been posting better profits. Net income as a percentage of sales for the 100 most profitable climbed from 6.7% in 1986 to 7.8% in 1987, and last year it hit 8.7% — consistently better than the comparable 4.1%, 4.8% and 5.3% averages for U.S. industry in the same years.

The overall picture



Who made the most profits

Here are the sheer profits

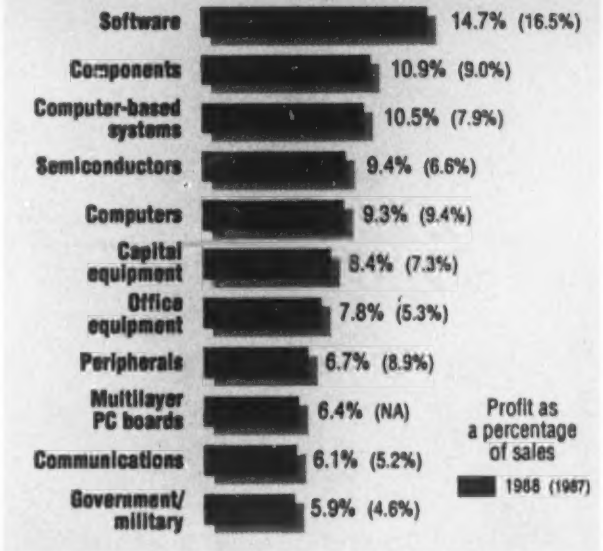
Quick quiz: On average, what was IBM's 1988 profit per day? The answer: almost $16 million. At $5.8 billion, the after-tax income of the United States electronics industry's largest company —IBM — is a figure that big boys such as NCR Corp. barely top in revenue. That figure is over twice as large as the sales of chip maker Intel Corp. and nearly three times as large as rival Compaq Computer Corp.'s sales.

Software's where the money is

In most industry segments, profitability climbed from 1987 to 1988. U.S. semiconductor makers showed one of the strongest gains — from 6.6% to 9.4% net income over sales. Components makers did well too, posting almost 11% after-tax.

Three sectors slipped in the income ratings: it's been no secret that computer peripherals firms, notably disk drive makers, have been under intense competitive pressure to make a buck. Computer makers lost some, and software firms slid, although software's still way out in front.

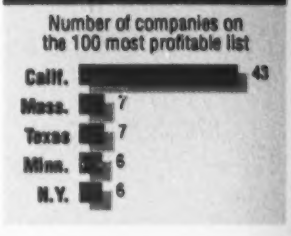
Most profitable industry segments



They don't just soak in hot tubs

Most of the most profitable U.S. electronics companies are in California — 43 of the top 100. A quick comparison with last year's list: the number of profitable companies in California grew from 37.

Hot profit spots



1988's most profitable U.S. companies

Rank	Company	Profit as a percentage of sales	Fiscal year 1988 sales ($ millions)	Fiscal year 1988 profits ($ millions)	Fiscal year ended	Location
1	Micron Technology	32.6%	$300.5	$98.0	8/88	Boise, Idaho
2	Symbol Technologies	22.7%	89.0	20.2	6/88	Bohemia, N.Y.
3	Microsoft	21.0%	590.8	123.9	6/88	Redmond, Wash.
4	Cray Research	20.7%	756.3	156.6	12/88	Minneapolis, Minn.
5	Digital Communications Associates	18.6%	227.5	42.2	6/88	Alpharetta, Ga.
6	Intel	15.8%	2,874.8	452.9	12/88	Santa Clara, Calif.
7	Chips and Technologies	15.6%	141.5	22.1	6/88	San Jose, Calif.
8	Ashton-Tate	15.6%	307.3	47.8	1/88	Torrance, Calif.
9	Xicor	15.5%	90.1	14.0	12/88	Milpitas, Calif.
10	Oracle Systems	15.2%	282.1	42.9	5/88	Belmont, Calif.
11	Cypress Semiconductor	14.9%	139.4	20.8	12/88	San Jose, Calif.
12	Computer Associates	14.4%	709.1	101.8	3/88	Garden City, N.Y.
13	Vishay Intertechnology	14.2%	109.0	15.5	6/88	Malvern, Pa.
14	Measurex	14.0%	265.2	37.1	11/88	Cupertino, Calif.
15	Medtronic	13.2%	653.3	86.5	4/88	Minneapolis, Minn.
16	Network Equipment Technologies	13.1%	90.6	11.9	3/88	Redwood City, Calif.
17	National Computer Systems	12.7%	209.2	26.5	1/89	Minneapolis, Minn.
18	Altos Computer Systems	12.6%	175.9	22.2	6/88	San Jose, Calif.
19	Lotus Development	12.6%	468.5	58.9	12/88	Cambridge, Mass.
20	Compaq Computer	12.4%	2,065.6	255.2	12/88	Houston, Texas
21	AMP	11.9%	2,670.0	319.0	12/88	Harrisburg, Pa.
22	Amdahl	11.9%	1,801.8	213.8	12/88	Sunnyvale, Calif.
23	Molex	11.8%	502.4	59.3	6/88	Lisle, Ill.
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27	Mentor Graphics	11.2%	300.8	33.5	12/88	Beaverton, Ore.
28	Stratus Computer	11.1%	265.3	29.3	12/88	Marlboro, Mass.
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39	3Com	8.9%	251.9	22.5	5/88	Santa Clara, Calif.
40	Pitney Bowes	8.9%	2,649.9	237.0	12/88	Stamford, Conn.
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42	Atari	8.7%	452.2	39.4	12/88	Sunnyvale, Calif.
43	Tellabs	8.7%	155.4	13.5	12/88	Lisle, Ill.
44	Analog Devices	8.6%	439.2	38.0	10/88	Norwood, Mass.
45	Network Systems	8.6%	131.5	11.4	12/88	Minneapolis, Minn.
46	Systematics	8.6%	179.5	15.4	8/88	Little Rock, Ark.
47	Archive	8.6%	122.7	10.5	9/88	Costa Mesa, Calif.
48	Tandy	8.3%	3,793.8	316.4	6/88	Fort Worth, Texas
49	Hewlett-Packard	8.3%	9,831.0	816.0	10/88	Palo Alto, Calif.
50	Silicon Graphics	8.2%	152.6	12.5	6/88	San Jose, Calif.

(Continued)

1988's most profitable U.S. companies

Rank	Company	Profit as a percentage of sales	Fiscal year 1988 sales ($ millions)	Fiscal year 1988 profits ($ millions)	Fiscal year ended	Location
51	Applied Magnetics	8.1%	$293.0	$23.7	9/88	Goleta, Calif.
52	Conner Peripherals	7.9%	256.6	20.3	12/88	San Jose, Calif.
53	KLA Instruments	7.8%	112.9	8.8	6/88	Santa Clara, Calif.
54	Iomega	7.7%	111.5	8.6	12/88	Roy, Utah
55	Ask Computer Systems	7.6%	142.4	10.8	6/88	Los Altos, Calif.
56	NCR	7.3%	5,989.9	439.3	12/88	Dayton, Ohio
57	Emulex	7.3%	125.1	9.1	6/88	Costa Mesa, Calif.
58	Tandem Computers	7.2%	1,314.7	94.5	9/88	Cupertino, Calif.
59	MTS Systems	7.1%	128.9	9.1	9/88	Minneapolis, Minn.
60	Watkins-Johnson	7.0%	292.2	20.6	12/88	Palo Alto, Calif.
61	Diceon Electronics	7.0%	140.7	9.9	9/88	Irvine, Calif.
62	Diebold	7.0%	450.6	31.3	12/88	Canton, Ohio
63	BancTec	6.9%	93.4	6.4	3/88	Dallas, Texas
64	Unisys	6.9%	9,902.0	680.6	12/88	Detroit, Mich.
65	Data-Design Laboratories	6.8%	107.0	7.3	6/88	Cucamonga, Calif.
66	AVX	6.7%	408.9	27.6	12/88	Great Neck, N.Y.
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68	Burr-Brown	6.5%	176.7	11.5	12/88	Tucson, Ariz.
69	Triad Systems	6.5%	127.4	8.3	9/88	Livermore, Calif.
70	Oak Industries	6.5%	197.8	12.9	12/88	Rancho Bernardo, Calif.
71	Sun Microsystems	6.3%	1,051.6	66.4	6/88	Mountain View, Calif.
72	LSI Logic	6.3%	378.9	23.8	12/88	Milpitas, Calif.
73	Ultimate	6.2%	209.2	13.0	4/88	East Hanover, N.J.
74	Intermec	6.1%	85.2	5.2	3/88	Lynnwood, Wa.
75	Wyse Technology	6.1%	456.6	28.0	3/88	San Jose, Calif.
76	Seagate Technology	6.1%	1,266.0	77.3	6/88	Scotts Valley, Calif.
77	Finnigan	6.0%	130.7	7.8	12/88	San Jose, Calif.
78	Raytheon	6.0%	8,192.0	489.6	12/88	Lexington, Mass.
79	Bolt Beranek and Newman	5.9%	305.2	18.1	6/88	Cambridge, Mass.
80	DSC Communications	5.9%	339.7	20.0	12/88	Plano, Texas
81	Scientific-Atlanta	5.8%	508.6	29.7	6/88	Atlanta, Ga.
82	Texas Instruments	5.8%	6,294.8	366.3	12/88	Dallas, Texas
83	MAI Basic Four	5.8%	420.8	24.5	9/88	Tustin, Calif.
84	GM Hughes Electronics	5.8%	11,243.6	653.3	12/88	Detroit, Mich.
85	Rexon	5.8%	155.5	9.0	9/88	Culver City, Calif.
86	General Instrument	5.7%	1,155.5	66.2	2/88	New York, N.Y.
87	Eldec	5.6%	104.1	5.9	3/88	Lynnwood, Wash.
88	Cipher Data Products	5.6%	185.4	10.4	6/88	San Diego, Calif.
89	Valid Logic Systems	5.6%	108.4	6.1	12/88	San Jose, Calif.
90	Dell Computer	5.6%	257.8	14.4	1/89	Austin, Texas
91	Western Digital	5.6%	768.3	43.0	6/88	Irvine, Calif.
92	Fluke	5.5%	224.5	12.4	9/88	Everett, Wash.
93	Park Electrochemical	5.5%	128.1	7.0	2/88	Lake Success, N.Y.
94	Andrew	5.5%	253.5	13.9	9/88	Orland Park, Ill.
95	Concurrent Computer	5.5%	263.1	14.4	6/88	Tinton Falls, N.J.
96	MSI Data	5.5%	90.2	4.9	3/88	Costa Mesa, Calif.
97	Convex Computer	5.4%	105.6	5.7	12/88	Richardson, Texas
98	Sparton	5.4%	206.3	11.2	6/88	Jackson, Mich.
99	Motorola	5.4%	8,250.0	445.0	12/88	Schaumburg, Ill.
100	Kulicke and Soffa	5.2%	83.5	4.4	9/88	Willow Grove, Pa.

Source: ELECTRONIC BUSINESS

1988's most profitable U.S. companies by industry segment

Capital equipment

	Profit as a percentage of sales	1988 rank
Vishay Intertechnology	14.2%	13
Gerber Scientific	11.2%	26
Applied Materials	11.0%	29
Hewlett-Packard	8.3%	49
KLA Instruments	7.8%	53
MTS Systems	7.1%	59
Fluke	5.5%	92
Kulicke and Soffa	5.2%	100
Weighted average	**8.4%**	

Communications

	Profit as a percentage of sales	1988 rank
Digital Communications Associates	18.6%	5
Network Equipment Technologies	13.1%	16
Novell	10.8%	31
ADC Telecommunications	9.4%	37
3Com	8.9%	39
Tellabs	8.7%	43
Network Systems	8.6%	45
Dynatech	6.7%	67
Bolt Beranek and Newman	5.9%	79
DSC Communications	5.9%	80
Scientific-Atlanta	5.8%	81
General Instrument	5.7%	86
Andrew	5.5%	94
Motorola	5.4%	99
Weighted average	**6.1%**	

Components (other than semiconductors)

	Profit as a percentage of sales	1988 rank
AMP	11.9%	21
Molex	11.8%	23
AVX	6.7%	66
Oak Industries	6.5%	70
Eldec	5.6%	87
Weighted average	**10.9%**	

Computer-based systems

	Profit as a percentage of sales	1988 rank
Symbol Technologies	22.7%	2
Measurex	14.0%	14
National Computer Systems	12.7%	17
Telxon	11.3%	25

(Continued)

Computer-based systems (continued)

	Profit as a percentage of sales	1988 rank
Mentor Graphics	11.2%	27
Ask Computer Systems	7.6%	55
BancTec	6.9%	63
Triad Systems	6.5%	69
Finnigan	6.0%	77
Valid Logic Systems	5.6%	89
MSI Data	5.5%	96
Weighted average	**10.5%**	

Computers

	Profit as a percentage of sales	1988 rank
Cray Research	20.7%	4
Altos Computer Systems	12.6%	18
Compaq Computer	12.4%	20
Amdahl	11.9%	22
DEC	11.4%	24
Stratus Computer	11.1%	28
Intergraph	11.0%	30
Apple Computer	9.8%	33
Teradata	9.5%	36
IBM	9.2%	38
Atari	8.7%	42
Tandy	8.3%	48
Silicon Graphics	8.2%	50
Tandem Computers	7.2%	58
Unisys	6.9%	64
Sun Microsystems	6.3%	71
MAI Basic Four	5.8%	83
Rexon	5.8%	85
Dell Computer	5.6%	90
Concurrent Computer	5.5%	95
Convex Computer	5.4%	97
Weighted average	**9.3%**	

Government

	Profit as a percentage of sales	1988 rank
Watkins-Johnson	7.0%	60
Raytheon	6.0%	78
GM Hughes Electronics	5.8%	84
Sparton	5.4%	98
Weighted average	**5.9%**	

Multilayer circuit boards

	Profit as a percentage of sales	1988 rank
Diceon Electronics	7.0%	61
Data-Design Laboratories	6.8%	65
Park Electrochemical	5.5%	93
Weighted average	**6.4%**	

Office equipment

	Profit as a percentage of sales	1988 rank
Pitney Bowes	8.9%	40
NCR	7.3%	56
Diebold	7.0%	62
Weighted average	**7.8%**	

Peripherals

	Profit as a percentage of sales	1988 rank
Archive	8.6%	47
Applied Magnetics	8.1%	51
Conner Peripherals	7.9%	52
Iomega	7.7%	54
Emulex	7.3%	57
Intermec	6.1%	74
Wyse Technology	6.1%	75
Seagate Technology	6.1%	76
Cipher Data Products	5.6%	88
Weighted average	**6.7%**	

Semiconductors

	Profit as a percentage of sales	1988 rank
Micron Technology	32.6%	1
Intel	15.8%	6
Chips and Technologies	15.6%	7
Xicor	15.5%	9
Cypress Semiconductor	14.9%	11
Silicon Systems	10.5%	32
Integrated Device Technology	9.6%	34
Richardson Electronics	9.5%	35
Analog Devices	8.6%	44
Burr-Brown	6.5%	68
LSI Logic	6.3%	72
Texas Instruments	5.8%	82
Western Digital	5.6%	91
Weighted average	**9.4%**	

Software

	Profit as a percentage of sales	1988 rank
Microsoft	21.0%	3
Ashton-Tate	15.6%	8
Oracle Systems	15.2%	10
Computer Associates	14.4%	12
Lotus Development	12.6%	19
Systematics	8.6%	46
Ultimate	6.2%	73
Weighted average	**14.7%**	

Net profits are from continuing operations after taxes and before extraordinary items

Source: ELECTRONIC BUSINESS

Top 100 R&D spenders increase investment by 15.7%

Exclusive ELECTRONIC BUSINESS ranking reveals a collective $18.2 billion spent on R&D by the top 100 in 1988. Software firms post the highest rates

BY BRUCE C.P. RAYNER and LINDA STALLMANN

There were no great surprises on the ELECTRONIC BUSINESS 1988 list of the top 100 research and development spenders in the electronics industry. Total R&D spending saw a double-digit percentage increase in 1988 over 1987, while R&D spending as a percentage of sales rose nominally. Software companies posted the highest rates of R&D spending, with four firms making the top 10, up from two last year.

Combined, the top 100 companies spent $18.2 billion on R&D in 1988, a 15.7% increase from the $15.7 billion logged in 1987. That mirrors a rise in sales for the same 100 companies of 15.4%, from $182.1 billion in 1987 to $210 billion in 1988. In the key category of R&D spending as a percentage of sales, the figure for the top 100 electronics companies rose from 8.6% in 1987 to 8.7% last year.

The top 100 R&D spenders is an exclusive ranking compiled by ELECTRONIC BUSINESS from United States-based publicly held companies in the electronics industry. To qualify, a company must derive at least 70% of its sales from electronics and be listed in the ELECTRONIC BUSINESS 200 [ELECTRONIC BUSINESS, July 24, 1989].

There were some companies that rose in the ranks and some that fell. Management Science America Inc., ranked No. 2, is making its first appearance this year. Dropping precipitously were Applied Materials Inc., down to No. 21 from No. 4 last year, and Intel Corp., which fell to the No. 31 spot from No. 11 in 1987.

But despite the usual ups and downs, there is some cause for concern with the underlying fundamentals of the top R&D performers in 1988. Cullinet Software Inc. is the top-ranked R&D spender for the second consecutive year. A developer of IBM mainframe software, Cullinet spent a robust 24.2% of its $217 million in sales on new product development. But the company's heavy R&D spending contributed to two years of red ink on its bottom line.

(Cullinet will never appear in our ranking again. It was bought in June by 25th-ranked Computer Associates International, also an IBM mainframe software company, for an estimated $320 million.)

Even meteoric Management Science America, a major software company, has its share of problems. MSA scrambled to reposition itself in the world of IBM's new Systems Application Architecture by spending heavily on product development last year. As a result, it reported losses of $33.6 million in its latest fiscal year ended December 1988.

Likewise, fourth-ranked automated test equipment maker LTX Corp. has been unprofitable in the first half of its 1989 fiscal year. And Cray Research Inc., ranked seventh, is restructuring and scaling down some of its R&D effort.

Is the combination of poor performance and high R&D spending a trend? Probably not. Sound financial health and high R&D spending do not necessarily go hand in hand. Indeed, good performance can lead to *lower* R&D spending. At least that is what happened at Advanced Micro Devices Inc.

Top-ranked in our R&D listing in 1986, AMD dropped to third place this year, spending about 18.5% of its sales on R&D, down from 30% two years earlier. The reason is threefold, according to a company official: the merger with Monolithic Memo-

Top U.S. R&D spenders

Rank 1988	Rank 1987	Company	R&D as a percentage of revenue	Total R&D expenditures ($ millions)	Industry segment
1	1	Cullinet Software	24.2%	$52.4	Software
2	—	Management Science America	23.6%	58.9	Software
3	2	Advanced Micro Devices	18.5%	208.3	Semiconductors
4	3	LTX	18.1%	31.6	Capital equipment
5	8	Lotus Development	17.9%	83.8	Software
6	37	Ashton-Tate	17.2%	52.9	Software
7	6	Cray Research	15.6%	117.8	Mainframes
8	—	Integrated Device Technology	15.5%	18.8	Semiconductors
9	9	Tektronix	15.3%	215.6	Capital equipment
10	12	GenRad	14.9%	30.7	Capital equipment
11	7	Analog Devices	13.8%	60.5	Semiconductors
12	5	Teradyne	13.4%	61.9	Capital equipment
13	15	Sun Microsystems	13.3%	139.9	Minicomputers
14	13	DSC Communications	13.2%	45.0	Communications
15	—	Chips & Technologies	13.2%	18.7	Semiconductors

Fiscal 1988 figures

Source: ELECTRONIC BUSINESS

Top U.S. R&D spenders

Total R&D spending
($ millions)

IBM	$5,925
Digital Equipment	1,307
Hewlett-Packard	1,019
Xerox	794
Unisys	713
Motorola	665
GM Hughes Electronics	551
Texas Instruments	494
NCR	416
Control Data	336
Honeywell	323
Intel	318
National Semiconductor	280
Apple Computer	273
Wang Laboratories	246

R&D spending per employee

Chips & Technologies	$60,828
Ashton-Tate	42,290
Lotus Development	33,535
Amdahl	26,626
Apple Computer	25,233
Microsoft	24,982
MSA	24,874
Applied Materials	24,633
Quantum	23,754
Cray Research	22,485
LTX	22,376
Cullinet Software	21,830
Mentor Graphics	19,786
Sun Microsystems	19,733
Tandem Computers	19,638

R&D spending growth
Percentage change from 1987

Oracle Systems	226.4%
Chips & Technologies	167.3%
Conner Peripherals	144.0%
Computer Associates	103.2%
Sun Microsystems	101.1%
Loral	100.7%
Maxtor	90.4%
Ashton-Tate	88.9%
Everex Systems	86.4%
Microsoft	83.3%
Western Digital	81.1%
Wyse Technology	74.3%
3Com	69.8%
Stratus Computer	61.6%
Novell	60.5%

Fiscal 1988 figures

Source: ELECTRONIC BUSINESS

ries Inc. in 1987 resulted in R&D redundancies and better leverage from R&D spending; leverage has also improved from the $10 million annual R&D contribution AMD makes to semiconductor consortium Sematech; and collaborative ventures with the likes of Sony Corp. and Siemens AG mean less R&D in-house. AMD's R&D spending will stay between 15% and 20% over the long-term, the official adds.

AMD is way ahead of the competition in the semiconductor industry when it comes to R&D spending as a percentage of sales. The industry average is 9.4%. But in dollar terms, Motorola Inc., the largest U.S. chip maker, outspent them all with $665 million in 1988, up from $524 million in 1987.

While Motorola's R&D investment is significant, it is dwarfed by IBM's budget. IBM spent only 10% of sales for R&D, but that represents $5.925 billion. Big Blue alone accounts for 32.6% of the total R&D spending by the ELECTRONIC BUSINESS 100 top R&D spenders, outdistancing Digital Equipment Corp., its closest R&D rival by more than four times.

Oracle Systems Corp., a database management software company, might not be an IBM, but it tops the fastest growing list with a whopping 226.4% growth in 1988 spending over 1987. This is almost double the growth of Genicom Corp., the fastest growth leader in 1987, which posted a growth rate of 143.3%.

But Oracle's R&D growth is somewhat overstated. According to company financial statements, 1987's R&D spending was adjusted downward due to an accounting change in the capitalization of software development costs, thus making the growth rate between the two years higher. Nonetheless, the increase is still impressive. The company spent

Software companies posted the highest rates of R&D spending with four firms making the top 10

$7.48 million or 13.5% of its sales on R&D in 1986, $9.95 million in 1987, and $25.7 million in 1988.

Is U.S. spending sufficient?

Is the U.S. electronics industry spending enough on research and development? The answer is uncertain, because up-to-date comparative figures are hard to come by. The U.S. electronics industry as a whole spent an estimated $60 billion in 1988 on R&D, of which about $33 billion was spent by the high-technology sector, excluding chemicals, according to the National Science Foundation (NSF). The ELECTRONIC BUSINESS top 100 accounts for about 55% of the industry's total.

Comparatively, U.S. industry spends more on R&D than Japan, France, Britain and Germany combined, says Carlos Kruytbosch, director for scientific indicators at the NSF. But in terms of a percentage of Gross National Product, the United States is running fairly evenly with all four. In fact, Kruytbosch says, U.S. industry's spending as a percentage of GNP is declining every year, while the same figure for the major trading partners is increasing.

But total dollar spending is not necessarily the critical issue, says Martyn Roetter, manager of information industry service at the consulting firm of Arthur D. Little Inc. "It is not so much whether or not the absolute level of R&D is right but whether those resources are being applied correctly," he says.

Improving efficiency of R&D funds includes speeding up development time and adopting some of Japan's development methods. That includes integrating manufacturing, design and even marketing into the development phase of the product. Roetter says one of the key issues with high-tech companies today is how they can improve the productivity of R&D funds. □

Top U.S. R&D spenders

Rank 1988	Rank 1987	Company	R&D as a percentage of revenue	Total R&D expenditures ($ millions)	Change from 1987	Fiscal 1988 revenue ($ millions)	Change from 1987	Fiscal 1988 net income ($ millions)	Change from 1987	Fiscal year ended
1	1	Cullinet Software	24.2%	$52.4	4.9%	$216.7	23.9%	-$47.0	NM	4/88
2	—	Management Science America	23.6%	58.9	11.8%	250.0	-3.3%	-33.6	NM	12/88
3	2	Advanced Micro Devices	18.5%	208.3	-15.9%	1,125.9	12.9%	19.3	NM	12/88
4	3	LTX	18.1%	31.6	36.3%	174.8	44.9%	7.0	NM	7/88
5	8	Lotus Development	17.9%	83.8	43.5%	468.5	18.4%	58.9	-18.2%	12/88
6	37	Ashton-Tate	17.2%	52.9	88.9%	307.3	14.9%	47.8	10.9%	1/89
7	6	Cray Research	15.6%	117.8	8.2%	756.3	10.0%	156.6	6.5%	12/88
8	—	Integrated Device Technology	15.5%	18.8	32.7%	121.1	55.6%	11.6	351.6%	3/88
9	9	Tektronix	15.3%	215.6	8.0%	1,411.9	1.1%	-16.7	NM	5/88
10	12	GenRad	14.9%	30.7	16.2%	205.9	6.2%	-6.2	NM	12/88
11	7	Analog Devices	13.8%	60.5	8.0%	439.2	18.6%	38.0	103.4%	10/88
12	5	Teradyne	13.4%	61.9	0.7%	462.3	22.4%	-3.3	NM	12/88
13	15	Sun Microsystems	13.3%	139.9	101.1%	1,051.6	95.6%	66.4	83.0%	6/88
14	13	DSC Communications	13.2%	45.0	10.0%	339.7	8.7%	20.0	37.4%	12/88
15	—	Chips & Technologies	13.2%	18.7	167.3%	141.5	76.3%	22.1	71.2%	6/88
16	36	Tandem Computers	12.9%	169.4	56.1%	1,314.7	27.0%	94.5	-10.5%	9/88
17	19	Amdahl	12.3%	221.0	23.5%	1,801.8	19.7%	213.8	50.6%	12/88
18	—	Concurrent Computer	12.2%	32.0	29.4%	263.1	6.2%	14.4	83.0%	6/88
19	17	Data General	12.1%	165.2	3.6%	1,364.7	7.1%	-15.5	NM	9/88
20	16	General DataComm	12.1%	23.3	-8.0%	192.2	-4.2%	-18.4	NM	9/88
21	4	Applied Materials	12.0%	43.5	39.3%	362.8	108.0%	40.0	NM	10/88
22	30	Microsoft	11.8%	69.8	83.3%	590.8	70.8%	123.9	72.4%	6/88
23	28	Apollo Computer	11.8%	76.9	25.9%	653.5	18.0%	0.2	-98.9%	12/88
24	38	Stratus Computer	11.5%	30.6	61.6%	265.3	44.1%	29.3	51.3%	12/88
25	14	Computer Associates	11.5%	81.5	103.2%	709.1	129.3%	101.8	179.0%	3/88
26	33	Digital Equipment	11.4%	1,306.5	29.3%	11,475.5	22.2%	1,305.6	14.8%	6/88
27	20	National Semiconductor	11.3%	280.2	28.0%	2,469.7	32.2%	62.7	NM	5/88
28	21	Digital Communications	11.3%	25.7	21.8%	227.5	25.4%	42.2	56.2%	6/88
29	31	Mentor Graphics	11.2%	33.8	39.8%	300.8	35.6%	33.5	65.0%	12/88
30	34	Intergraph	11.1%	89.2	32.2%	800.2	24.8%	88.0	25.9%	12/88
31	11	Intel	11.1%	318.3	22.5%	2,874.8	50.7%	452.9	158.0%	12/88
32	23	Prime Computer	10.9%	174.3	58.9%	1,594.6	65.9%	13.0	-80.0%	12/88
33	25	Coherent	10.5%	19.7	9.5%	188.1	18.3%	-1.3	NM	9/88
34	32	Fluke	10.4%	23.4	5.5%	224.5	8.8%	12.4	519.4%	9/88
35	27	Hewlett-Packard	10.4%	1,019.0	13.1%	9,831.0	21.5%	816.0	26.7%	10/88
36	42	Westmark International	10.3%	37.8	34.8%	365.3	25.1%	10.4	NM	12/88
37	40	IBM	9.9%	5,925.0	9.0%	59,681.0	10.1%	5,491.0	4.4%	12/88
38	29	LSI Logic	9.8%	37.0	27.8%	378.9	44.5%	23.8	121.9%	12/88
39	44	ADC Telecommunications	9.7%	17.4	12.5%	179.9	7.8%	17.0	11.1%	10/88
40	41	VLSI Technology	9.6%	21.2	26.2%	221.2	28.6%	6.7	-16.8%	12/88
41	26	Cipher Data Products	9.4%	17.4	-13.3%	185.4	4.0%	10.4	141.1%	6/88
42	46	Dynatech	9.4%	34.4	25.9%	367.8	20.7%	24.5	5.6%	3/88
43	50	3Com	9.3%	23.4	69.8%	251.9	128.3%	22.5	102.3%	5/88
44	22	Control Data	9.3%	335.7	-13.7%	3,628.3	7.8%	1.7	-93.2%	12/88
45	75	Oracle Systems	9.1%	25.7	226.4%	282.1	114.9%	42.9	174.5%	5/88
46	67	Maxtor	8.8%	24.0	90.4%	271.2	54.7%	14.1	-36.8%	3/88
47	48	AMP	8.8%	238.0	16.7%	2,699.7	16.5%	319.1	27.8%	12/88
48	55	Western Digital	8.8%	67.7	81.1%	768.3	66.1%	43.0	0.4%	6/88
49	35	Perkin-Elmer	8.5%	98.6	-29.7%	1,165.5	-12.6%	60.0	NM	7/88
50	—	Ask Computer Systems	8.3%	11.9	43.3%	142.4	44.9%	10.8	34.9%	6/88

NM = Not meaningful. The company lost money in the base year

(Continued)

Top U.S. R&D spenders

Rank 1988	Rank 1987	Company	R&D as a percentage of revenue	Total R&D expenditures ($ millions)	Change from 1987	Fiscal 1988 revenue ($ millions)	Change from 1987	Fiscal 1988 net income ($ millions)	Change from 1987	Fiscal year ended
51	—	Burr-Brown	8.3%	$14.7	19.1%	$176.7	25.8%	$11.5	169.5%	12/88
52	51	Medtronic	8.1%	53.1	26.1%	653.3	30.1%	86.5	17.2%	4/88
53	57	Motorola	8.1%	665.0	26.9%	8,250.0	23.0%	445.0	44.5%	12/88
54	59	Micropolis	8.0%	28.4	30.5%	353.1	22.5%	-19.4	NM	12/88
55	60	Wang Laboratories	8.0%	246.0	15.8%	3,068.4	8.2%	92.7	31.1%	6/88
56	58	Texas Instruments	7.8%	494.0	15.4%	6,294.8	12.5%	366.3	42.6%	12/88
57	45	Applied Magnetics	7.7%	22.7	16.3%	293.0	38.3%	23.7	66.9%	9/88
58	56	Storage Technology	7.7%	67.5	12.3%	874.0	16.5%	44.2	132.8%	12/88
59	68	Dataproducts	7.7%	26.7	19.3%	345.2	1.9%	-20.2	NM	3/88
60	62	Measurex	7.2%	19.2	14.8%	265.2	16.7%	37.1	38.2%	11/88
61	65	Diasonics	7.2%	20.3	9.9%	281.6	5.2%	9.8	-35.9%	12/88
62	73	Unisys	7.2%	713.0	19.4%	9,902.0	1.9%	680.6	17.8%	12/88
63	70	NCR	7.0%	416.4	16.8%	5,989.9	6.2%	439.3	4.8%	12/88
64	64	Xerox	6.9%	794.0	10.0%	11,476.0	11.2%	73.0	-87.4%	12/88
65	53	Varian Associates	6.9%	80.2	-0.6%	1,170.6	19.1%	27.8	29.9%	9/88
66	63	Apple Computer	6.7%	272.5	42.3%	4,071.4	53.0%	400.3	84.0%	9/88
67	61	Gerber Scientific	6.5%	17.1	3.1%	264.0	17.9%	29.6	40.6%	4/88
68	43	Quantum	6.4%	12.1	4.9%	188.5	56.1%	-3.2	NM	3/88
69	69	Watkins-Johnson	6.3%	18.3	8.0%	292.2	10.6%	20.6	20.3%	12/88
70	96	Scientific-Atlanta	5.9%	30.0	49.5%	508.6	2.7%	29.7	22.3%	6/88
71	79	M/A-COM	5.9%	25.0	2.2%	424.2	-2.7%	18.4	NM	9/88
72	—	Everex Systems	5.9%	15.6	86.4%	266.7	69.4%	10.5	21.8%	7/88
73	49	TIE/communications	5.7%	14.6	-32.0%	255.3	2.0%	-17.0	NM	12/88
74	—	Novell	5.7%	16.0	60.5%	281.2	53.8%	30.4	49.6%	10/88
75	76	Cherry Electrical Products	5.7%	11.0	14.8%	194.6	21.2%	7.4	169.8%	2/88
76	91	Esterline	5.7%	16.1	33.0%	284.4	9.5%	8.4	NM	10/88
77	90	Andrew	5.6%	14.1	35.7%	253.5	13.6%	13.9	264.5%	9/88
78	77	Harris	5.6%	116.9	-0.9%	2,099.3	1.0%	65.4	-22.6%	6/88
79	80	Molex	5.3%	26.6	25.8%	502.4	29.9%	59.3	36.5%	6/88
80	83	Wyse Technology	5.3%	24.2	74.3%	456.6	75.6%	28.0	54.2%	3/88
81	66	Aydin	5.0%	8.5	-15.6%	169.7	13.7%	8.4	-4.9%	12/88
82	87	Sprague Technologies	5.0%	25.1	20.7%	504.6	15.4%	13.2	266.7%	12/88
83	99	GM Hughes Electronics	4.9%	550.9	32.4%	11,243.6	7.3%	634.6	21.8%	12/88
84	74	Bolt Beranek and Newman	4.8%	14.7	2.6%	305.2	30.5%	18.1	NM	6/88
85	—	Rexon	4.7%	7.4	49.4%	155.5	53.4%	9.0	44.9%	9/88
86	—	Atari	4.7%	21.4	18.4%	452.2	24.7%	39.4	-20.3%	12/88
87	88	Litton Industries	4.7%	227.9	8.7%	4,863.9	10.1%	167.0	20.9%	7/88
88	95	Honeywell	4.5%	323.4	11.6%	7,148.3	7.0%	-434.9	NM	12/88
89	92	Loral	4.5%	64.1	100.7%	1,440.8	108.8%	74.3	29.4%	3/88
90	—	Tandon	4.4%	13.7	33.3%	309.3	7.0%	-19.9	NM	12/88
91	84	International Rectifier	4.3%	7.7	-4.1%	178.6	17.6%	-12.1	NM	6/88
92	89	Kollmorgen	4.2%	14.5	1.9%	344.8	14.5%	14.1	4840.4%	12/88
93	85	Augat	4.1%	13.1	-18.6%	321.0	2.5%	-22.8	NM	12/88
94	—	Seagate Technology	4.0%	50.1	49.3%	1,257.0	31.2%	77.3	-44.7%	6/88
95	82	AST Research	3.8%	15.7	41.2%	412.7	100.4%	15.1	15.6%	6/88
96	94	Zenith Electronics	3.7%	100.6	-2.7%	2,685.7	13.7%	5.3	NM	12/88
97	86	Genicom	3.6%	10.6	-28.9%	291.4	-3.5%	1.0	-92.0%	12/88
98	100	Compaq Computer	3.6%	74.9	58.9%	2,065.6	68.7%	255.2	87.3%	12/88
99	72	Datapoint	3.5%	11.6	-39.9%	330.8	6.0%	8.0	NM	7/88
100	—	Conner Peripherals	3.4%	8.6	144.0%	256.6	126.6%	19.8	73.8%	12/88

NM = Not meaningful. The company lost money in the base year

(Continued)

Top U.S. R&D spenders by industry segment

Capital equipment

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Hewlett-Packard	$1,019.0	10.4%	$11,713
Tektronix	215.6	15.3%	13,402
Perkin-Elmer	98.6	8.5%	8,984
Varian Associates	80.2	6.9%	6,798
Teradyne	61.9	13.4%	13,176
Applied Materials	43.5	12.0%	24,633
LTX	31.6	18.1%	22,376
GenRad	30.7	14.9%	15,343
Fluke	23.4	10.4%	9,763
Gerber Scientific	17.1	6.5%	9,262
Esterline	16.1	5.7%	5,328
Segment total	**$1,637.6**		
Weighted averages		**10.5%**	**$11,452**

Communications

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Motorola	$665.0	8.1%	$6,520
DSC Communications	45.0	13.2%	16,265
Dynatech	34.4	9.4%	11,250
Scientific-Atlanta	30.0	5.9%	8,720
Digital Communications	25.7	11.3%	17,922
3Com	23.4	9.3%	17,372
General DataComm	23.3	12.1%	9,692
ADC Telecommunications	17.4	9.7%	10,358
Novell	16.0	5.7%	10,104
Bolt Beranek and Newman	14.7	4.8%	4,667
TIE/communications	14.6	5.7%	9,721
Andrew	14.1	5.6%	5,274
Datapoint	11.6	3.5%	4,320
Segment total	**$935.2**		
Weighted averages		**8.0%**	**$7,209**

Components

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
AMP	$238.0	8.8%	$9,876
Molex	26.6	5.3%	4,512
Sprague Technologies	25.1	5.0%	3,061
Augat	13.1	4.1%	3,639
Cherry Electrical Products	11.0	5.7%	3,895
Segment total	**$313.9**		
Weighted averages		**7.4%**	**$7,032**

Computer-based systems

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Hewlett-Packard	$1,019.0	10.4%	$11,713
Intergraph	89.2	11.1%	12,216
Mentor Graphics	33.8	11.2%	19,786
Coherent	19.7	10.5%	11,584
Measurex	19.2	7.2%	7,323
Gerber Scientific	17.1	6.5%	9,262
Ask Computer Systems	11.9	8.3%	17,237
Segment total	**$1,209.9**		
Weighted averages		**10.3%**	**$11,761**

Government

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Motorola	$665.0	8.1%	$6,520
GM Hughes Electronics	550.9	4.9%	5,679
Texas Instruments	494.0	7.8%	6,527
Honeywell	323.4	4.5%	4,126
Litton Industries	227.9	4.7%	4,144
Harris	116.9	5.6%	5,173
Varian Associates	80.2	6.9%	6,798
Loral	64.1	4.5%	4,680
M/A-COM	25.0	5.9%	3,883
Watkins-Johnson	18.3	6.3%	5,813
Aydin	8.5	5.0%	4,238
Segment total	**$2,574.3**		
Weighted averages		**5.9%**	**$5,503**

Mainframes

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
IBM	$5,925.0	9.9%	$15,306
Unisys	713.0	7.2%	7,667
NCR	416.4	7.0%	6,940
Control Data	335.7	9.3%	10,021
Amdahl	221.0	12.3%	26,626
Cray Research	117.8	15.6%	22,485
Segment total	**$7,728.9**		
Weighted averages		**9.5%**	**$13,163**

Medical

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Medtronic	$53.1	8.1%	$9,042
Westmark International	37.8	10.3%	11,701
Diasonics	20.3	7.2%	12,243
Segment total	**$111.2**		
Weighted averages		**8.6%**	**$10,333**

(Continued)

Top U.S. R&D spenders by industry segment

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Microcomputers			
IBM	$5,925.0	9.9%	$15,306
Apple Computer	272.5	6.7%	25,233
Zenith Electronics	100.6	3.7%	2,794
Compaq Computer	74.9	3.6%	10,849
Atari	21.4	4.7%	12,002
AST Research	15.7	3.8%	8,718
Everex Systems	15.6	5.9%	9,759
Tandon	13.7	4.4%	9,263
Segment total	**$6,439.4**		
Weighted averages		**9.2%**	**$14,390**
Minicomputers			
IBM	$5,925.0	9.9%	$15,306
Digital Equipment	1,306.5	11.4%	10,411
Hewlett-Packard	1,019.0	10.4%	11,713
Prime Computer	174.3	10.9%	14,070
Tandem Computers	169.4	12.9%	19,638
Data General	165.2	12.1%	10,712
Sun Microsystems	139.9	13.3%	19,733
Apollo Computer	76.9	11.8%	17,307
Concurrent Computer	32.0	12.2%	9,280
Stratus Computer	30.6	11.5%	17,860
Segment total	**$9,038.7**		
Weighted averages		**10.3%**	**$13,847**
Office equipment			
IBM	$5,925.0	9.9%	$15,306
Xerox	794.0	6.9%	7,930
NCR	416.4	7.0%	6,940
Wang Laboratories	246.0	8.0%	7,961
Harris	116.9	5.6%	5,173
Segment total	**$7,498.3**		
Weighted averages		**9.1%**	**$12,482**
Peripherals			
Storage Technology	$67.5	7.7%	$7,940
Seagate Technology	50.1	4.0%	1,670
Micropolis	28.4	8.0%	8,876

Continued next column

Fiscal 1988 R&D expenditures	Total ($ millions)	As a percentage of revenue	Per employee
Peripherals (continued)			
Dataproducts	$26.7	7.7%	$7,509
Wyse Technology	24.2	5.3%	5,771
Maxtor	24.0	8.8%	7,635
Applied Magnetics	22.7	7.7%	2,401
Cipher Data Products	17.4	9.4%	8,481
AST Research	15.7	3.8%	8,718
Everex Systems	15.6	5.9%	9,759
Quantum	12.1	6.4%	23,754
Genicom	10.6	3.6%	2,875
Rexon	7.4	4.7%	6,308
Segment total	**$322.1**		
Weighted averages		**6.0%**	**$4,423**
Semiconductors			
Motorola	$665.0	8.1%	$6,520
Texas Instruments	494.0	7.8%	6,527
Intel	318.3	11.1%	15,304
National Semiconductor	280.2	11.3%	7,432
Advanced Micro Devices	208.3	18.5%	11,004
Western Digital	67.7	8.8%	10,288
Analog Devices	60.5	13.8%	11,319
LSI Logic	37.0	9.8%	11,448
VLSI Technology	21.2	9.6%	13,006
Integrated Device Technology	18.8	15.5%	14,135
Chips & Technologies	18.7	13.2%	60,828
Burr-Brown.	14.7	8.3%	9,963
International Rectifier	7.7	4.3%	3,367
Segment total	**$2,212.2**		
Weighted averages		**9.4%**	**$7,977**
Software			
Lotus Development	$83.8	17.9%	$33,535
Computer Associates	81.5	11.5%	18,230
Microsoft	69.8	11.8%	24,982
Management Science America	58.9	23.6%	24,874
Ashton-Tate	52.9	17.2%	42,290
Cullinet Software	52.4	24.2%	21,830
Oracle Systems	25.7	9.1%	11,648
Segment total	**$425.0**		
Weighted averages		**15.0%**	**$23,625**

Capital spending hits four-year high in 1988

But don't look for more big gains by the ELECTRONIC BUSINESS top 100 capital spenders in 1989. A "be cautious" leveling off is expected

BY BRUCE C.P. RAYNER and LINDA STALLMANN

Capital spending by the top U.S. electronics companies hit a four-year high in 1988, posting a healthy 28% growth over 1987. But last year's good performance is expected to be the peak of the cycle as market watchers are forecasting a leveling off in capital spending this year and next as a result of fallout from higher interest rates and a slowing economy.

Total capital spending by the top 100 publicly held U.S. electronics companies in an exclusive ELECTRONIC BUSINESS survey rose to $18.3 billion in 1988, up from $14.3 billion in 1987. But while this represents a healthy commitment to expansion, the industry nonetheless remains cautious about expanding capacity too fast after the boom/bust experience of four years ago. In nominal terms, the 1988 figure is still below the peak of $20.8 billion reached in the boom year of 1984.

Topping the ELECTRONIC BUSINESS list of capital spenders last year was none other than IBM, with a total of $5.39 billion, up 25% from 1987. IBM accounts for 29% of the total spending by the top 100 companies. Indeed, most of the industry's capital spending is done by the biggest companies: the top 10 companies on the list spent 68.5% of the total. To qualify for inclusion on the list, a company must be a publicly held U.S. company, derive at least 70% of its sales from electronics and be listed on the ELECTRONIC BUSINESS 200 ranking [ELECTRONIC BUSINESS, July 24, 1989].

But while IBM spent the most, it was DRAM-maker Micron Technology Inc.'s spending that grew fastest. It outstripped all the rest by increasing capital spending a whopping 877.6% to $44.3 million as it capitalized on the DRAM shortage. The company reportedly will boost spending by 376% in 1989, according to semiconductor analyst Jonathan Joseph, Montgomery Securities, in San Francisco.

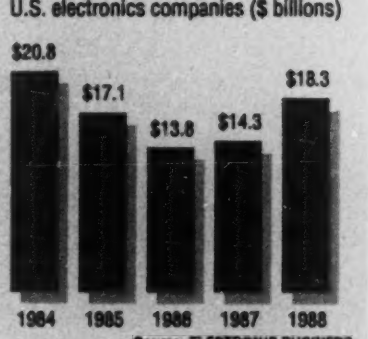
Surprisingly, it was neither the heavy-spending computer sector nor the capital intensive semiconductor sector that captured last year's top growth catagory. Instead, it was the tiny software segment that took first place with an average 1988 growth rate of 79.9%.

In dollar terms, software accounted for only 1.2% of capital spending by the top 100 electronics companies on the ELECTRONIC BUSINESS survey. At the top of the software spenders was Ashton-Tate Corp., up 459% to $36.4 million as a result of acquisitions. The company plans further expansion in Singapore this year.

Behind fast-growing software came peripherals, with a 55.8% growth rate in capital spending in 1988. It was in this category that the wildest swings took place. Seagate Technology, in 13th place last year, rose in the overall capital spending ranks from 30th place in 1987, while 45th-ranked Storage Technology Inc. plunged from 14th place as it recovers from three years in bankruptcy.

Capital spending levels

Total capital spending by the top 100 U.S. electronics companies ($ billions)



Source: ELECTRONIC BUSINESS

Expect stagnation

What's in store for 1989?

Stagnation, says Cahners Economics' Madeline Franchi. "In general, growth in business investment by electronics companies in new plant and equipment reached its peak at the end of 1988, and we are seeing some definite softening in 1989," she says. But economist Franchi anticipates a turnaround in the electronic industry's capital spending plans in 1990 and a "resurgence" in 1991 as the economy recovers from the slowdown of late 1989 and early 1990.

But industry observers say that even though the sluggish economy will slow total capital spending in 1989, electronics companies have no choice but to continue to spend on productivity-improving equipment. That means out of a smaller pie, less will be spent on increasing capacity while more will go to replacement and modernization.

Indeed, Data Resources Inc. is forecasting the percentage of capital spending devoted to expansion to drop from 32% in 1988 to 28% in 1989 for all manufacturing industry. The trend is reflected in the subcategories of electrical machinery, 29% to 21%; nonelectrical machinery, 24% to 16%; and instruments, 34% to 33%.

Compounding this shift is the ever-increasing pressure from foreign competition. For instance, the top 10 Japanese chip makers plan to increase spending by 75% to $4.8 billion this fiscal year, ending next March, while the top 11 U.S. companies will increase spending by only 22% to $3.2 billion in calendar 1989, says analyst Joseph. □

Top U.S. capital spenders

Rank 1988	Rank 1987	Company	Total capital expenditures ($ millions)	Change from 1987	Capital expenditures as a percentage of revenue	Capital expenditures to net cash flow after dividends	Fiscal 1988 revenue ($ millions)	Fiscal year ended
1	1	IBM	$5,390.0	25.2%	9.0%	70.5%	$59,681.0	12/88
2	3	Digital Equipment	1,517.6	102.8%	13.2%	82.8%	11,475.5	6/88
3	2	Xerox	1,399.0	49.3%	8.5%	167.7%	16,441.0	12/88
4	5	Motorola	873.0	32.7%	10.6%	96.5%	8,250.0	12/88
5	4	Unisys	669.9	-7.1%	6.8%	60.0%	9,902.0	12/88
6	6	Hewlett-Packard	648.0	27.8%	6.6%	57.9%	9,831.0	10/88
7	8	Texas Instruments	628.1	35.7%	10.0%	93.9%	6,294.8	12/88
8	7	GM Hughes Electronics	533.0	13.5%	4.7%	55.7%	11,243.6	12/88
9	11	Intel	477.5	58.3%	16.6%	71.9%	2,874.8	12/88
10	9	NCR	420.4	8.0%	7.0%	66.1%	5,989.9	12/88
11	10	Honeywell	327.7	7.7%	4.6%	-136.0%	7,148.3	12/88
12	12	Pitney Bowes	309.5	22.9%	11.7%	93.5%	2,649.9	12/88
13	30	Seagate Technology	284.4	262.8%	22.6%	221.7%	1,257.0	6/88
14	18	Amdahl	278.9	76.8%	15.5%	88.4%	1,801.8	12/88
15	22	Wang Laboratories	273.6	113.8%	8.9%	79.8%	3,068.4	6/88
16	23	Compaq Computer	273.5	141.5%	13.2%	89.9%	2,065.6	12/88
17	13	Litton Industries	230.1	-5.2%	4.7%	64.6%	4,863.9	7/88
18	17	AMP	220.3	28.2%	8.2%	59.6%	2,699.7	12/88
19	25	National Semiconductor	198.9	110.0%	8.1%	85.5%	2,469.7	5/88
20	20	Tandem Computers	185.1	30.0%	14.1%	102.6%	1,314.7	9/88
21	15	Control Data	169.8	-4.8%	4.7%	86.6%	3,628.3	12/88
22	27	Apple Computer	144.0	67.2%	3.5%	32.9%	4,071.4	9/88
23	24	Prime Computer	140.9	40.2%	8.8%	80.6%	1,594.6	12/88
24	31	Sun Microsystems	117.3	54.2%	11.2%	100.0%	1,051.6	6/88
25	16	LSI Logic	101.0	-42.1%	26.6%	128.5%	378.9	12/88
26	21	Advanced Micro Devices	97.7	-29.1%	8.7%	56.7%	1,125.9	12/88
27	19	Data General	96.6	-32.4%	7.1%	116.6%	1,364.7	9/88
28	26	Tandy	94.2	1.1%	2.5%	28.1%	3,793.8	6/88
29	33	Perkin-Elmer	83.6	25.7%	7.2%	94.9%	1,165.5	7/88
30	49	Cray Research	82.0	104.3%	10.8%	29.5%	756.3	12/88
31	28	Harris	81.2	-2.9%	3.9%	47.9%	2,099.3	6/88
32	32	Tektronix	78.1	16.9%	5.5%	164.9%	1,411.9	5/88
33	35	Microsoft	71.6	23.5%	12.1%	51.2%	590.8	6/88
34	41	Molex	68.7	38.9%	13.7%	68.5%	502.4	6/88
35	45	Intergraph	66.5	52.3%	8.3%	54.3%	800.2	12/88
36	63	Micropolis	64.0	186.8%	18.1%	-1,354.1%	353.1	12/88
37	37	Apollo Computer	60.3	12.3%	9.2%	141.7%	653.5	12/88
38	34	General Instrument	60.0	-5.0%	5.2%	46.2%	1,155.5	2/88
39	58	Applied Magnetics	55.5	115.5%	18.9%	137.8%	293.0	9/88
40	57	Lotus Development	55.2	107.5%	11.8%	57.4%	468.5	12/88
41	40	VLSI Technology	55.2	10.1%	24.9%	149.4%	221.2	12/88
42	38	E-Systems	53.7	5.1%	3.7%	57.6%	1,443.1	12/88
43	50	Loral	50.9	49.1%	3.5%	38.6%	1,440.8	3/88
44	46	Analog Devices	47.3	9.9%	10.8%	63.4%	439.2	10/88
45	14	Storage Technology	47.2	-73.7%	5.4%	35.7%	874.0	12/88
46	62	DSC Communications	45.9	97.7%	13.5%	103.0%	339.7	12/88
47	—	Micron Technology	44.3	877.6%	14.7%	35.9%	300.5	8/88
48	44	Varian Associates	43.2	-6.5%	3.7%	69.2%	1,170.6	9/88
49	52	SCI Systems	42.8	44.6%	5.5%	110.3%	777.7	6/88
50	68	Maxtor	38.1	118.8%	14.1%	153.0%	271.2	3/88

(Continued)

Top U.S. capital spenders

Rank 1988	Rank 1987	Company	Total capital expenditures ($ millions)	Change from 1987	Capital expenditures as a percentage of revenue	Capital expenditures to net cash flow after dividends	Fiscal 1988 revenue ($ millions)	Fiscal year ended
51	61	Sprague Technologies	$38.1	56.8%	7.6%	80.7%	$504.6	12/88
52	—	Ashton-Tate	36.4	459.4%	11.8%	52.0%	307.3	1/89
53	48	Western Digital	35.9	-11.6%	4.7%	50.1%	768.3	6/88
54	55	Medtronic	33.5	18.0%	5.1%	33.0%	653.3	4/88
55	36	Zenith Electronics	32.9	-40.6%	1.2%	68.0%	2,685.7	12/88
56	51	AVX	32.5	2.2%	8.0%	61.0%	408.9	12/88
57	70	Oracle Systems	31.0	83.3%	11.0%	55.4%	282.1	5/88
58	—	Conner Peripherals	30.4	75.5%	11.8%	122.5%	256.6	12/88
59	73	Mentor Graphics	29.3	99.3%	9.7%	62.6%	300.8	12/88
60	64	Bolt Beranek and Newman	28.8	29.8%	9.4%	84.9%	305.2	6/88
61	—	Integrated Device Technology	27.9	59.3%	23.0%	110.8%	121.1	3/88
62	43	Avnet	24.7	-47.8%	1.4%	38.9%	1,829.3	6/88
63	56	M/A-COM	23.2	-13.4%	5.5%	58.8%	424.2	9/88
64	—	Burr-Brown	21.3	89.6%	12.1%	83.1%	176.7	12/88
65	—	Wyse Technology	20.8	157.8%	4.6%	59.5%	456.6	3/88
66	—	Concurrent Computer	20.4	42.7%	7.8%	72.8%	263.1	6/88
67	86	Applied Materials	19.8	72.5%	5.5%	38.5%	362.8	10/88
68	47	Teradyne	19.8	-51.7%	4.3%	75.9%	462.3	12/88
69	59	Datapoint	19.6	-23.3%	5.9%	82.2%	330.8	7/88
70	—	3Com	18.9	201.5%	7.5%	61.7%	251.9	5/88
71	92	Computer Associates	18.9	80.6%	2.7%	11.8%	709.1	3/88
72	75	LTX	18.1	33.0%	10.3%	89.4%	174.8	7/88
73	74	Stratus Computer	17.8	28.8%	6.7%	43.4%	265.3	12/88
74	71	Cherry	17.8	15.0%	9.1%	92.2%	194.6	2/88
75	53	Augat	17.7	-39.8%	5.5%	-147.8%	321.0	12/88
76	78	MAI Basic Four	16.4	24.7%	3.9%	63.5%	420.8	9/88
77	76	Kollmorgen	15.8	16.8%	4.6%	65.3%	344.8	12/88
78	100	Fluke	15.7	89.1%	7.0%	68.2%	224.5	9/88
79	90	Gerber Scientific	15.4	45.7%	5.8%	44.9%	264.0	4/88
80	—	Novell	15.3	-28.0%	5.5%	40.4%	281.2	10/88
81	80	Dynatech	15.1	20.0%	4.1%	39.5%	367.8	3/88
82	—	AST Research	14.6	132.8%	3.5%	67.9%	412.7	6/88
83	67	Digital Communications	13.6	-28.1%	6.0%	26.5%	227.5	6/88
84	87	ADC Telecommunications	13.5	21.2%	7.5%	51.7%	179.9	10/88
85	—	International Rectifier	12.9	114.6%	7.2%	-8,571.5%	178.6	6/88
86	84	Andrew	12.8	10.3%	5.1%	46.1%	253.5	9/88
87	85	GenRad	12.4	7.3%	6.0%	119.1%	205.9	12/88
88	94	Genicom	12.2	29.9%	4.2%	87.3%	291.4	12/88
89	81	Watkins-Johnson	11.6	-5.7%	4.0%	39.4%	292.2	12/88
90	91	Westmark International	11.3	7.2%	3.1%	54.1%	365.3	12/88
91	95	Marshall Industries	10.8	17.4%	2.6%	55.1%	420.4	5/88
92	—	Diasonics	10.5	30.4%	3.7%	52.8%	281.6	12/88
93	—	Measurex	10.3	48.5%	3.9%	23.5%	265.2	11/88
94	—	Scientific-Atlanta	10.1	50.5%	2.0%	25.1%	508.6	6/88
95	77	CTS	10.0	-25.1%	3.6%	49.2%	275.6	12/88
96	—	Wyle Laboratories	9.4	148.8%	2.3%	93.0%	410.9	1/89
97	98	Coherent	9.1	6.8%	4.8%	159.0%	188.1	9/88
98	65	Recognition Equipment	9.0	-58.2%	3.5%	87.5%	260.8	10/88
99	—	Mark IV Industries	9.0	68.0%	2.2%	31.9%	403.0	2/88
100	69	Cubic	7.0	-59.1%	1.9%	50.3%	364.9	9/88

(Continued)

Top U.S. capital spenders by segment

Capital expenditures
FY 1988

Capital equipment

	Total ($ millions)	Change from 1987
Hewlett-Packard	$648.0	27.8%
Perkin-Elmer	83.6	25.7%
Tektronix	78.1	16.9%
Applied Materials	19.8	72.5%
Teradyne	19.8	-51.7%
LTX	18.1	33.0%
Fluke	15.7	89.1%
Gerber Scientific	15.4	45.7%
GenRad	12.4	7.3%
Total, weighted avg.	**$910.9**	**23.6%**

Communications

	Total ($ millions)	Change from 1987
Motorola	$873.0	32.7%
General Instrument	60.0	-5.0%
DSC Communications	45.9	97.7%
Bolt Beranek and Newman	28.8	29.8%
Datapoint	19.6	-23.3%
3Com	18.9	201.5%
Novell	15.3	-28.0%
Dynatech	15.1	20.0%
Digital Communications	13.6	-28.1%
ADC Telecommunications	13.5	21.2%
Andrew	12.8	10.3%
Scientific-Atlanta	10.1	50.5%
Total, weighted avg.	**$1,126.7**	**27.9%**

Components

	Total ($ millions)	Change from 1987
AMP	$220.3	28.2%
Molex	68.7	38.9%
Sprague Technologies	38.1	56.8%
AVX	32.5	2.2%
Cherry Electrical	17.8	15.0%
Augat	17.7	-39.8%
CTS	10.0	-25.1%
Total, weighted avg.	**$405.0**	**20.7%**

Computer-based systems

	Total ($ millions)	Change from 1987
Hewlett-Packard	$648.0	27.8%
Intergraph	66.5	52.3%
Mentor Graphics	29.3	99.3%
Gerber Scientific	15.4	45.7%
Measurex	10.3	48.5%
Coherent	9.1	6.8%
Recognition Equipment	9.0	-58.2%
Total, weighted avg.	**$787.6**	**28.5%**

Distribution

	Total ($ millions)	Change from 1987
Avnet	$24.7	-47.8%
Marshall Industries	10.8	17.4%
Wyle Laboratories	9.4	148.8%
Total, weighted avg.	**$44.9**	**-25.5%**

Government

	Total ($ millions)	Change from 1987
Motorola	$873.0	32.7%
Texas Instruments	628.1	35.7%
GM Hughes Electronics	533.0	13.5%
Honeywell	327.7	7.7%
Litton Industries	230.1	-5.2%
Harris	81.2	-2.9%
E-Systems	53.7	5.1%
Loral	50.9	49.1%
Varian Associates	43.2	-6.5%
SCI Systems	42.8	44.6%
M/A-COM	23.2	-13.4%
Watkins-Johnson	11.6	-5.7%
Cubic	7.0	-59.1%
Total, weighted avg.	**$2,905.5**	**19.2%**

Mainframes

	Total ($ millions)	Change from 1987
IBM	$5,390.0	25.2%
Unisys	669.9	-7.1%
NCR	420.4	8.0%
Amdahl	278.9	76.8%
Control Data	169.8	-4.8%
Cray Research	82.0	104.3%
Total, weighted avg.	**$7,011.0**	**21.1%**

Medical

	Total ($ millions)	Change from 1987
Medtronic	$33.5	18.0%
Westmark International	11.3	7.2%
Diasonics	10.5	30.4%
Total, weighted avg.	**$55.3**	**17.7%**

Microcomputers

	Total ($ millions)	Change from 1987
IBM	$5,390.0	25.2%
Compaq Computer	273.5	141.5%
Apple Computer	144.0	67.2%
Tandy	94.2	1.1%
Zenith Electronics	32.9	-40.6%
AST Research	14.6	132.8%
Total, weighted avg.	**$5,949.1**	**27.7%**

Minicomputers

	Total ($ millions)	Change from 1987
IBM	$5,390.0	25.2%
Digital Equipment	1,517.6	102.8%
Hewlett-Packard	648.0	27.8%
Tandem Computers	185.1	30.0%
Prime Computer	140.9	40.2%
Sun Microsystems	117.3	54.2%
Data General	96.6	-32.4%
Apollo Computer	60.3	12.3%
Concurrent Computer	20.4	42.7%
Stratus Computer	17.8	28.8%
MAI Basic Four	16.4	24.7%
Total, weighted avg.	**$8,210.5**	**34.2%**

Office equipment

	Total ($ millions)	Change from 1987
IBM	$5,390.0	25.2%
Xerox	1,399.0	49.3%
NCR	420.4	8.0%
Pitney Bowes	309.5	22.9%
Wang Laboratories	273.6	113.8%
Harris	81.2	-2.9%
Total, weighted avg.	**$7,873.6**	**29.2%**

Peripherals

	Total ($ millions)	Change from 1987
Seagate Technology	$284.4	262.8%
Micropolis	64.0	186.8%
Applied Magnetics	55.5	115.5%
Storage Technology	47.2	-73.7%
Maxtor	38.1	118.8%
Conner Peripherals	30.4	75.5%
Wyse Technology	20.8	157.8%
AST Research	14.6	132.8%
Genicom	12.2	29.9%
Total, weighted avg.	**$567.1**	**55.8%**

Semiconductors

	Total ($ millions)	Change from 1987
Motorola	$873.0	32.7%
Texas Instruments	628.1	35.7%
Intel	477.5	58.3%
National Semiconductor	198.9	110.0%
LSI Logic	101.0	-42.1%
Advanced Micro Devices	97.7	-29.1%
VLSI Technology	55.2	10.1%
Analog Devices	47.3	9.9%
Micron Technology	44.3	877.6%
Western Digital	35.9	-11.6%
Integrated Device Tech.	27.9	59.3%
Burr-Brown	21.3	89.6%
International Rectifier	12.9	114.6%
Total, weighted avg.	**$2,620.9**	**30.9%**

Software

	Total ($ millions)	Change from 1987
Microsoft	$71.6	23.5%
Lotus Development	55.2	107.5%
Ashton-Tate	36.4	459.4%
Oracle Systems	31.0	83.3%
Computer Associates	18.9	80.6%
Total, weighted avg.	**$213.0**	**79.9%**

Source: ELECTRONIC BUSINESS